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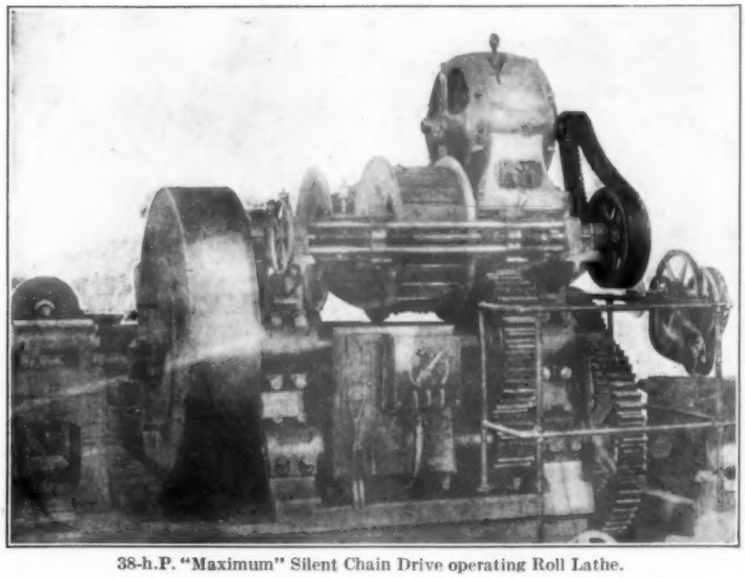

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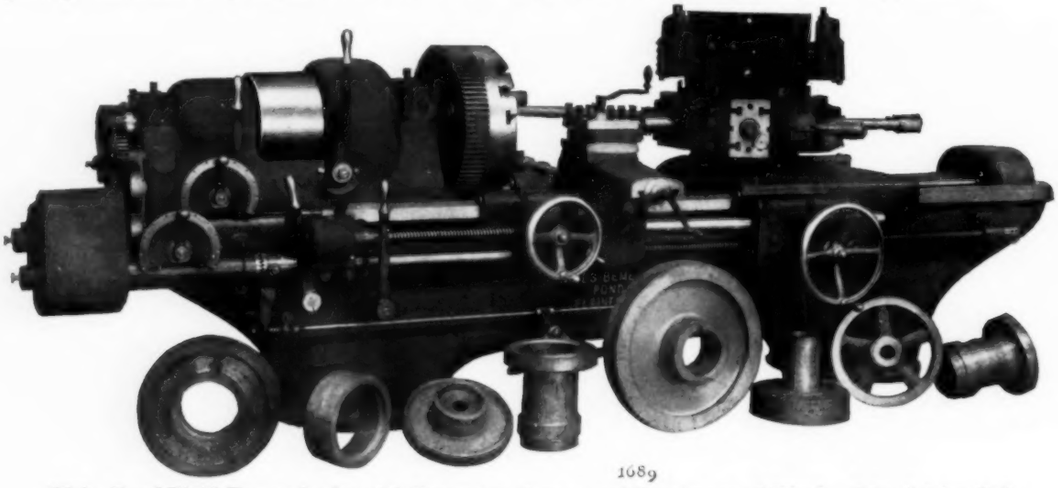

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(*See pages* 43, 44, and 45)

Diamond Dies for Drawing Wire*

By E. A. Suverkrop†

The tools, machines and methods used in the manufacture of diamond and sapphire dies. How diamond dust is prepared and graded.

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†Associate editor.

The manufacture of wire-drawing dies has long been looked upon as one of the secret trades, especially so when one considers the making of diamond and sapphire dies. Many manufacturers are prone to throw a cloak of mystery about their work, often contending that their particular method of finishing and mounting is the only way to produce a satisfactory die. Through the courtesy of John H. O'Donnell, president of the Waterbury Wire Die Company, Waterbury, Conn., I am able, for the first time I believe, to give an illustrated description of the art of wire-die making.

This company is intimately connected with the Waterbury Machine Company, and makes the die equipment which goes with their wire-drawing machines.

Various materials are used for wire dies. Chilled iron is used for the larger sizes of copper and brass wire, steel dies for steel and iron wire and diamond and sapphire dies for the smaller sizes of all materials.

Diamond dies, while greater in first cost than either chilled iron or steel dies, are very durable and with them only can the very small sizes of wire be successfully drawn.

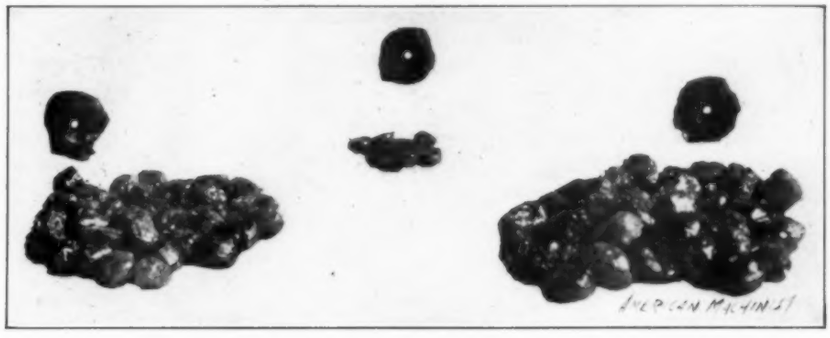


FIG. 1. ROUGH AND DRILLED DIAMONDS

DIAMOND DIES

These are made from "bortz" which are defective gem diamonds, poor in color or having other defects such as flaws which make them unfit for jewelry. The diamonds in the rough range from 2 to 12 carats in weight and cost from $1.50 to $5 per carat according to quality, quantity purchased and market conditions.

The actual cutting of the diamond is done with diamond either in the shape of small splinters or dust in various grades of fineness. Bortz for the manufacture of dust can be bought for from 60 to 90 cents per carat, depending on the market and the quantity bought.

In the foreground in Fig. 1 is shown about 500 dollars worth of bortz just as it comes from the mines. The stones shown, taken as a whole, are of a dirty greenish color, somewhat translucent and transparent in parts but none of them even in coloring throughout. In the center is a small pile of bortz which has been flattened on one side preparatory to drilling and at the back are three drilled stones ready for mounting and finishing.

FLATTENING THE BACK

The first operation is to flatten the back of the stone. This is done on a flat-steel lap into which diamond dust has been rolled. The stone is cemented by means of diamond cement (shellac) to a suitale holder. One end of the holder is supported outside the lap. The diamond rests on the face of the lap and if necessary weight, beyond that of the holder, can be applied to hasten the cutting operation. After the diamond is sufficiently flattened, it is cemented to a chuck mounted in a small lathe similar to that shown in Fig. 10, so that the face can be countersunk.

COUNTERSINKING

A small splinter of bortz is selected for this job and held in a pair of pliers. This is used as a tool to countersink the face, making a starting place for the diamond drill used in the next operation. The reason why a splinter of diamond is used for this purpose is that providing both the die blank and the splinter are equally hard, the splinter wears as fast, or faster, than the diamond it is cutting and new cutting edges of the same or other splinters must be brought in contact with the work. For this reason a shaped diamond countersink would be useless.

The depth and area of countersink vary, of course, with the size of the die and the time it takes to countersink a diamond depends not only on the area and depth of the countersink, but also upon the hardness of the diamond and there is considerable variation in hardness of different diamonds. The countersink must also be located to avoid drilling through flaws.

As a fair average it takes about half an hour to make a countersink 1/32 inch deep.

The next operation on the die is drilling, but as this is done with diamond dust a description of the making and grading of diamond dust would not be out of place as the next operation.

MAKING AND GRADING DIAMOND DUST FOR GRINDING AND LAPPING

Fig. 2 shows the pestle and mortar for reducing the bortz to dust.

The body *A* of the mortar is of cast iron bored to receive the hardened-steel mortar proper *B*. The hole *C* is about an inch in diameter and is rounded at the bottom to conform to the shape of the pestle and also to allow the bortz to fall by gravity to the center. The hardened-steel pestle head *D* is a fairly easy fit in *C*. The shank *F* is a sliding fit in the cover *E* which is secured to *A* by three screws. The object of the cover is to prevent the broken diamond from flying, although some mortars are made without a cover and also without the cast-iron body.

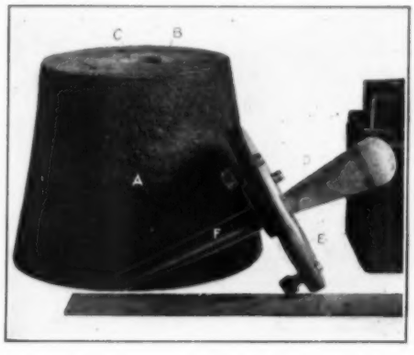


FIG. 2. PESTLE AND MORTAR FOR GRINDING DIAMOND DUST

About 10 carats of bortz is placed in the mortar, the pestle is inserted and the lid screwed down. About five minutes hammering on the pestle reduces the bortz sufficiently for separating.

About half a pint of olive oil is placed in a glass receptacle. The diamond dust is poured into the oil and the oil and diamond dust thoroughly stirred.

The mixture is then allowed to settle

for five minutes and the oil and suspended diamond dust is poured into another receptacle. This 5-minute dust is called No. 1, and is used for drilling.

The decanted oil and dust is allowed to settle for one hour when the oil and suspended dust is again poured off. The dust deposited in one hour is called No. 2 and is used for lapping.

The third precipitation is for six hours, the oil and suspended dust being decanted

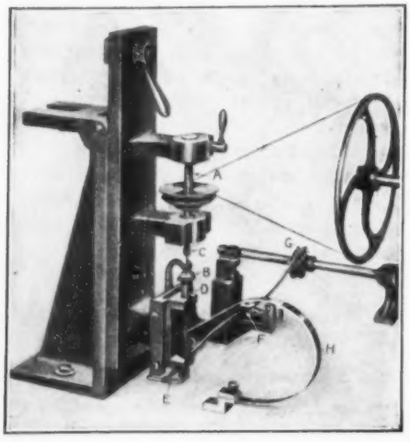


FIG. 3. AUTOMATIC DIAMOND-DRILLING MACHINE

as before. The residue is called No. 3 and is used for finishing.

The final precipitation takes from 12 to 15 hours, is called No. 4 and is also used for finishing.

DRILLING

Fig. 3 shows the drilling machine. It consists of a headstock and tailstock set on a vertical bed. The spindle *A* runs in

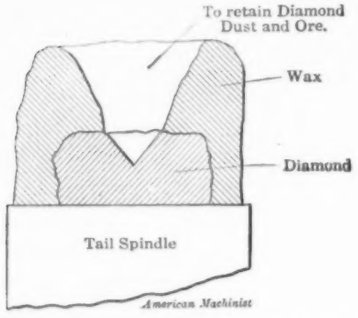


FIG. 4. SECTION OF DIAMOND IN PLACE ON THE DRILL PRESS

a tapered babbitt bearing in the lower housing and has an adjustable conical back bearing in the upper housing. For a belt light cotton string is used. Mounted on the nose of the spindle is a small chuck *C* which carries the drill made from an ordinary sewing needle of the desired size. When the size of the die demands something smaller than any of the commercial needles they are sharpened either with a file or with a emery wheel.

The diamond *B* is cemented on the end of the tail spindle *D* in the manner shown in the line cut, Fig. 4, with the countersunk face up. Wax is pressed around it, leaving a depression in the center for No. 1 diamond dust and olive oil. The countersink in the diamond is, of course, in line with the drill in the spindle.

Pivoted at *F* is a small rod, one end of which rides on an eccentric *G* while the other end rests on top of the wire *E* attached to the end of the tail spindle. A very light adjustable spring *H* engages a slot in the tail spindle and lifts it toward the drilling needle. This lifting movement can be regulated and the pressure exerted by the diamond on the charged needle is a yielding spring pressure not liable to damage either the needle or the diamond.

The spindle of the drilling machine runs at about 6000 revolutions per minute and the tail spindle makes about 150 reciprocations in the same time.

Diamond dies run in sizes from say 0.0008 inch to 0.091 inch. Dies for wire up to say 0.0200 inch diameter are from 1/16 to 1/32 inch thick; from 0.020 to 0.091 inch from ⅛ to 3/16 inch thick.

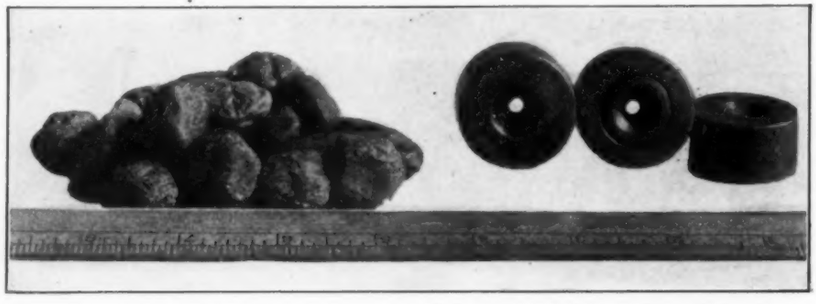


FIG. 5. SAPPHIRES IN THE ROUGH AND SAPPHIRE DIES

Below 0.020 inch the average time for drilling would be 10 hours or less; above 0.020 inch from 10 to 18 hours.

SAPPHIRE DIES

Sapphire dies, while considerably softer and cheaper than diamonds, are very much more durable than either steel or chilled iron (in the hardness scale diamonds are 10, sapphires 9 and the hardest carbon steel about 7).

The countersinking and drilling of sapphires is done in exactly the same way as that given for diamonds. In size, the sapphire dies range from say 0.040 to 0.150 inch in the hole, and up to ⅝ inch thick by ¾ inch diameter.

To drill a sapphire die 0.150 inch diameter by ⅝ inch thick takes about two hours, so that it will readily be seen that they are considerably softer than diamonds. A sapphire die of average size can be made complete by an expert workman in about seven hours.

In Fig. 5 to the left are shown a number of sapphire crystals in the rough. They are dirty bluish black pieces of stone, which might almost be mistaken for pieces of anthracite coal. Rough sapphires are sold by the ounce and the price varies with the market, an average price would be $3.50 per ounce.

ROUGH FINISHING THE HOLE

After the hole is drilled the next operation is to rough finish the hole in the diamond to within say about 0.001 inch of finished size.

The rough finishing is done on the machine shown in Fig. 6. In this machine the general arrangement is on the same principle as the drilling machine shown in

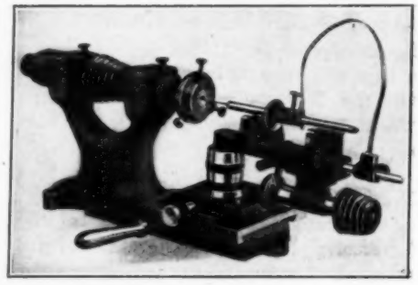


FIG. 6. HORIZONTAL LAPPING MACHINE

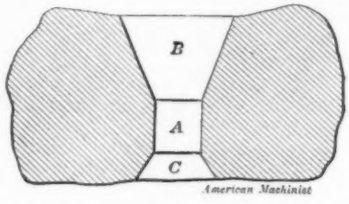


FIG. 7. SECTION OF DIAMOND DIE

Fig. 3, but the spindle carrying the lap is mounted on a pivot which in turn is mounted on two slides permitting almost universal adjustment of the lap with relation to the diamond. In this operation the lap does not rotate but has a reciprocating motion the spring forcing the spindle forward while the lever forces it back. The lever obtains its motion from the face cam *A*.

The object of the adjustments is to permit the lap to shape the hole to the approximate shape it will have in the finished die.

The approximate shape of the finished die is shown in the line cut, Fig. 7. The

part marked *A* is called the bearing, and it is here that the wire is drawn to size. The material which is to be drawn determines the length of the bearing. For copper the bearing is short, for brass longer, and for steel longer still.

The needle is roughed for the reception and retention of the diamond dust. This is done either by hand with a file if the needle is soft, or on the emery wheel if it be hard.

the lap becomes headed over and in that case has to be eaten out with acid. For this purpose a mixture of two parts nitric and one part hydrochloric acids will do the trick. The two acids should be kept in separate bottles as when mixed they oxidize rapidly and will not keep for any length of time. The mixture will eat any kind of metal and makes a very rapid and good etching fluid for marking tools.

For rough finishing sapphire dies, copper laps are considered better than steel, as they hold the diamond dust better.

The speed of the rough-finishing machine is from 2000 to 2500 revolutions per minute.

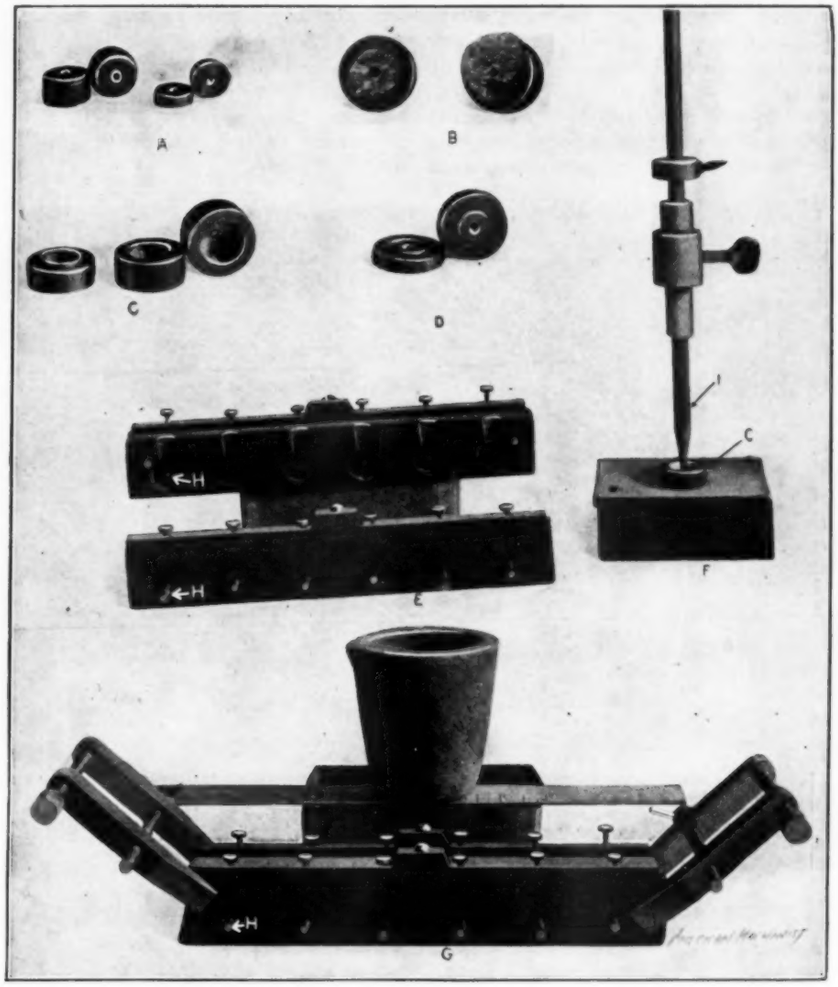


FIG. 8. APPLIANCES FOR SETTING DIAMOND DIES

Under the microscope the cutting part of the lap looks like one of the old fashioned draw-filed butcher steels. The diamond dust (No. 2) beds itself in these fine scratches left by the file or emery wheel and thereafter the wear on the lap itself is slight.

From time to time the diamond is taken from the machine and tested for size. This is done by pointing a piece of soft-brass wire and drawing it through the die and measuring it. Diamonds cut in this operation at the rate of about from 0.0015 to 0.002 inch per hour.

Occasionally a lap will seize and break in the die. It is usual to take a needle and sharpen the point to a suitable taper and push the broken lap out. Sometimes

SETTING DIAMOND AND SAPPHIRE DIES

The diamond is next set in a holder. At *E* and *F*, Fig. 8, is shown a metal mold which is used to cast either very low-carbon steel or wrought iron around the rough-finished diamond. The pins *H* engage the hole in the diamond and center it in the mold. Previous to setting the diamond in the mold, the mold is smoked either with a gas flame or a candle. This protects the mold and partly prevents chilling of the iron. After as many of the diamonds as it is intended to set are in place, the mold is closed and clamped as shown at *G*, Fig. 8. Iron is then melted in a small crucible and poured into the various molds. The thermit process has also been used for melting the iron but is said to be unsatisfactory.

At *A*, Fig. 8, to the left, are shown two dies just as they come from the mold. To the right in the same figure are shown two dies after turning to size.

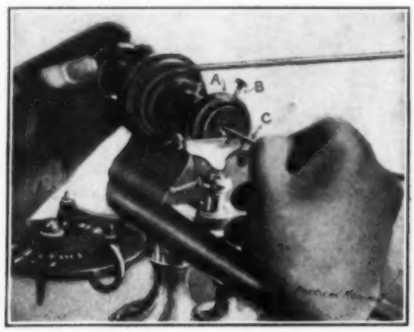


FIG. 10. TRUING A DIE IN THE LATHE

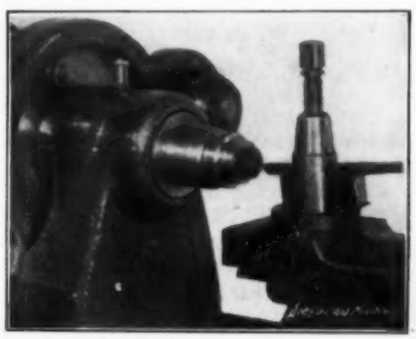


FIG. 9. TURNING THE CAST-IRON SETTING

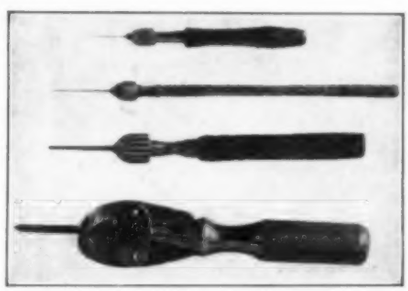


FIG. 11. DIAMOND LAPS

The turning is done in an ordinary lathe, the pieces being held in a spring collet as shown in Fig. 9.

After being set in the cast wrought iron, the dies are set in brass. Two of the brass settings 1⅛ inches diameter by ¼ to ⅜ thick are shown at *C*, in Fig. 8. One of the brass settings is placed in the centering device shown to the right and one of the finished iron settings is put in it. The pointed rod *I* is then entered in the hole in the diamond centering it in the

mold. The setting *C* is then heated with a bunsen burner and melted brass is poured in. This stage is shown at *B*, Fig. 8. The surplus brass is then turned off and the diamond die is ready for finishing. The cups *C* are turned slightly taper inside, being larger at the bottom of the hole.

Sometimes the diamonds are plated with copper before casting the metal around them. As copper will not stick direct to the diamond, it is first coated with plumbago, and then the copper is deposited by means of a plating dynamo in the usual way. Some diemakers assert that this is the correct way to prepare a die for setting, while others say that the soft copper coating permits the diamond to become loose in the iron setting. Even with the method previously described the diamond sometimes becomes loose and must be removed by turning the brass out in the lathe.

Setting Sapphire Dies

The drilled sapphires are set direct in brass. They are centered in a fixture similar to that at *F*, Fig. 8, and the melted brass is poured around them without any preliminary setting in cast wrought iron.

Finishing the Hole to Size

It takes from three to four years' experience before a man can finish a small die, say 0.003 inch or less.

The final finishing is done on a small watch lathe with the lap held in the hand. Mounted on the spindle of the lathe is a small cup chuck provided with three screws, as shown at *A*, Fig. 10. The periphery of the die setting is spotted in three places as seats for the three adjusting screws *B*.

The operator centers the die by the hole in the diamond. This is done by holding a piece of wire *C*, pointed like a center punch, in the hole in the diamond. The spindle is rotated by the left hand and the eccentricity of the die is indicated between the wire and the small hand rest. The adjusting screws are used to center the die, and when it becomes necessary to remove the die for examination, only one of the three adjusting screws is slackened. In this way when the die is replaced in the same position the previous centering is preserved.

Finishing the Die

The tools shown in Fig. 11 are used for polishing and finishing the holes in diamond dies. The tools or laps are either ordinary sewing needles or steel wire filed to size. The filing is a sort of cross between regular filing and draw filing, leaving scores lengthways in the lap for the retention of the diamond dust.

With the die centered in the lathe chuck, finishing to size begins. A suitable lap is held in a pin vise as shown in Fig. 11. The lathe is run at from 3000 to 3500 turns per minute. The handle of the lap is held flexibly in the right hand and after dipping the point in number 3 or 4 diamond dust and olive oil it is pushed straight into the hole and drawn out again.

The outward movement is slightly swinging so as to shape the opening as shown in Fig. 7 at *B*.

The removal of the final 0.001 inch left from the roughing operation takes about an hour. From time to time as the lapping progresses the die is removed and examined, as regards shape and size. The die is tested (by drawing a piece of wire) both for size and roundness. Regarding roundness it may be mentioned that dies for drawing wire for pins must be as near round as possible because when the points of the pins are formed, the wire is rolled and if the wire is as little as 0.0002 inch out of round the wire is apt to slide, instead of roll, producing a chisel-shaped point instead of a conical point.

The bearing as shown at *A*, Fig. 7, varies as previously stated, with the size of the die and the material which is to be drawn, from about 0.006 inch for the smallest up to 0.093 inch for a die for wire 0.091 inch thick. Dies over 0.030 inch are finished in automatic machines as shown in Fig. 6; those below this size by hand.

Life of Diamond Dies

Diamond dies for drawing copper are guaranteed to hold their size for six months, but if properly used, will hold their size for five or six times the guarantee limit. On gold and gold-plated wire with proper care, a diamond die after six or seven years' constant use will not have increased 0.0002 inch in size.

The Waterbury Wire Die Company, besides a very large stock of bortz and sapphires in the rough, has constantly on hand a stock of about 5000 diamond dies of various sizes.

Fig. 12 gives a general idea how many machines on this work can be gotten into small space. It shows part of the automatic drilling and rough-lapping machines on one bench only, those at the bottom being a continuation, to the right, of the top row. The horizontal lappers at the bottom are about 8 inches in length over all.

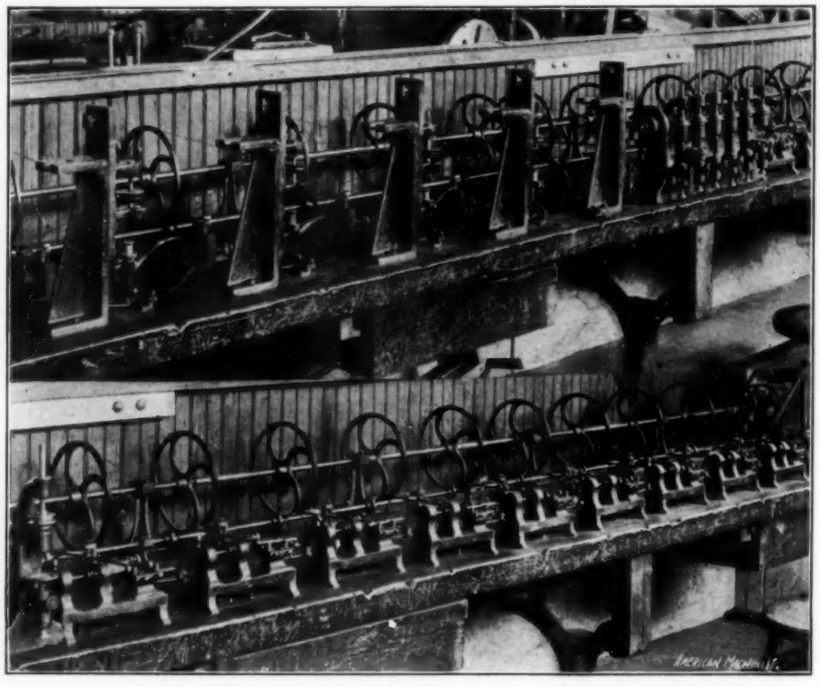


Fig. 12. Automatic Vertical Drills and Automatic Horizontal Lapping Machine

For the prices of bortz and sapphires I am indebted to David Dessau, of S. Dessau's Sons, 180 Broadway, New York.

The spelter industry of the country enjoyed a year of continued normal growth. The total production of spelter in the United States in 1910 broke all records; the production from domestic sources alone exceeded the total production for any previous year in the history of the industry and exceeded the domestic production for any other year by 20,000 tons. Coupled with this increase in production there was a decrease in imports and at the same time exports were more than quadrupled. The production of primary spelter from domestic ore in 1910 is estimated at 250,052 short tons and from foreign ore at 17,371 tons, a total of 267,423 tons.

The Chemical Coloring of Metals—I*

By F. Reinboth

Fundamental principles of metal coloring; the mechanical cleaning, degreasing and chemical cleaning before the coloring processes proper are performed.

It is wise to experiment with a sample before proceeding with the work of coloring.

*Translated from *Maschinenbau*, Berlin.

With the same measure of progress by which general metal working has reached its present position, one of its special departments, metal coloring, has developed also and it has reached a high point of perfection. The object has not alone been to improve appearance, but still more to protect against air, water, carbonic acid, etc. Copper, zinc and their alloys, as well as iron, offer little resistance along that line, but soon lose their luster. This is where metal coloring plays a leading part.

Almost every metal workman sometimes finds it necessary to employ artificial coloring for protection of the metal, as well as to improve its appearance. In almost all numbers of technical papers, especially in the inquiry department, are queries on this subject. Most of the questioners are novices in metal coloring who have been given some piece of work on which they want advice. They hope that this will bring them out of their difficulty but generally find too late that it fails to do so. The reason is, that learning the recipe from the paper does not make them masters of the art. In order to get good results, there are many things to be considered, which can only be learned through experience.

Fundamental Principles

If now I state some of the most important points to be held in mind for good results in metal coloring, and give a number of recipes for the principal operations, it will only be by way of suggestion to one or another of the readers that he take up one of the methods indicated, test it thoroughly, and with its assistance master the art, so that he shall be equipped to meet the occasions that arise by using his own abilities. Let it be taken as a rule that in every case, if possible, a trial shall be made with a piece of material similar to that of the object in hand before proceeding with the operation proper. A second fundamental principle is adequately to prepare the material for the color, since it is not indifferent whether the surface be rough, "brush" finished, or polished. The coloring results will then always turn out differently. It also makes a difference whether small or large objects, and whether single ones or quantities are to be colored.

In repetition work, it is further to be borne in mind that the coloring fluid soon loses by use, and then produces different tones from those at the start, for which reason it ought to be renewed, or more of the original compound added. It is further to be noted that a direct chemical coloring is generally possible only for those metals which form colored oxides, sulphides or other compounds. For a few metals the surface has first to be properly prepared; for example, zinc articles often are copper plated before a color can be brought out on them, since most of the compounds of zinc are white.

In itself, the coloring of a metal is not difficult. The difficulty lies far more in the demands necessarily made on the color, that it shall be beautifully artistic in appearance, be durable, and retain the metallic character. If, in artistic work, it is only required to imitate a precious metal, the choice of coloring is still an extremely delicate matter. It is not to be supposed that this object is attained for all articles and all materials without thinking of other points than the mere coloring. The coloring, for example, ought not to cover up the workmanship; thus fine engraved work ought not to be obscured under a thick patination, nor should wrought-iron work be coated with copper. Furthermore, in the coloring, account must be taken of the purpose of the article. It would be objectless and contrary to reason to give something made of copper a bronze coat if it were to be set in the open air.

These being the general principles for a metal coloring operation, we shall now turn to the practical part of the subject. Here we are met by a new condition, without fulfilling which the success of a coloring is generally unthinkable. It is the complete, regular cleansing of the metal surface from dirt, grease, oxide layers, etc. The metal must be absolutely clean and its entire surface equally competent to take up the chemical agent which is to produce the color. We must consider from the start whether the final result is to be a luster or a matte color. Then we undertake the cleansing process, which consists essentially of three factors, the mechanical cleaning, the degreasing, and the chemical cleaning.

Mechanical Cleaning and Degreasing

The mechanical cleaning consists in the removal of dirt and dust by washing with water or scouring off more or less with fine wire or bristle brushes, sometimes with the aid of fine sand, pumice stone, etc. After this follows a washing with clean water. The degreasing of small objects is done by dipping them in benzine, ether, or some other solvent for the grease. Because of the fire hazard, this work ought to be done only by daylight. Larger articles are best boiled in caustic soda (one part caustic soda in ten parts water), which turns the grease to soap. Zinc, tin and britannia metal, as also soft-soldered objects should not, however, be boiled with this lye, since it attacks them. For them is used a bath of carbonate of soda or of potash (one part to ten of water). After subsequent boiling they are well washed with water. A sign of proper grease removal is a regular wetting of the surface by water. Since, after grease removal, the articles should not be touched with the fingers, they ought either to be fastened on wires beforehand or handled with tongs or rubber gloves.

In recent times, the removal of grease by electrolytic methods has been undertaken. These methods, however, are only employed where in addition to coloring, there is done a good deal of galvanic electroplating which requires the use of current. The electrolytic degreasing bath consists essentially in a sufficiently concentrated solution of caustic soda or potash, or of sodium or potassium carbonates. In this degreasing process the alkali entering at the cathode saponifies the grease, while the developed oxygen mechanically sets free the grease and dirt.

Chemical Cleansing

After the grease removal comes the chemical cleaning, which consists mainly in removing the layers of oxide. This is accomplished through an acid mixture, a so called "pickle" whose composition for the various metals is determined by experience. This chapter is of so much importance to the success of metal coloring that we must enter into the subject rather elaborately, since a bad pickling generally spoils the results of the work. Zinc, which ordinarily is only covered with a thin film of sub-oxide, is best pickled with a mixture of 10 to 20 parts water and one part concentrated sulphuric acid. In the preparation of the sulphuric acid and water mixture the acid ought always to be poured in while the water is stirred, and not *vice versa*. So much heat is developed by the reaction that if the method were reversed, the stuff would fly about and cause burns. When the layers of sub-oxide are thick, and soaking in the above mixture long enough to remove them would dissolve the zinc itself, it is better to use a cool

mixture of equal parts sulphuric acid and nitric acid the mixture being diluted to 36 degrees Baumé specific gravity. In one or two seconds the zinc is usually completely cleaned. It is then copiously washed with water often renewed, a condition which, in all pickling and indeed all metal coloring, must be strictly complied with. If the thickness of the outside layer necessitates repeated pickling, the objects are previously to be dried.

After being used often the pickling bath loses its power and the zinc articles then have a dull appearance. Such an exhausted pickle can still be employed for matte pickling of zinc, if we keep adding to it as much zinc scrap as it will dissolve and finally giving it a weak nitric acidity.

Large objects of cast-zinc ware, which are not suitable to place in the pickle, are best rubbed with a solution of ammonio-potassic tartrate, made of 250 grams of tartar in one liter of water heated to 176 degrees Fahrenheit and ammonium carbonate added to it until ebulition ceases. The solution is allowed to act for some time, and the object is rubbed off with a sponge or soft brush, with a broth of whiting and water. Finally a washing with water is given. If the objects cannot be taken directly to the coloring process, they are either dried with a cloth free of grease or better yet, laid in a solution of tartar or ammonio-potassic tartrate.

In order to remove the oxide layer from copper and its alloys, resort is generally had to a so called "yellow pickle," or dip, a mixture of 100 parts concentrated sulphuric acid (66 degrees Baumé) and 75 parts nitric acid (40 degrees Baumé). Here also there is a difference between luster and matte pickling. For the former purpose there is added to the "yellow pickle" some cooking salt, about 10 grams to 3.5 kilograms of the pickle.

For a matte surface the solution is preferably as follows: One kilogram* nitric acid (36 degrees Baumé), one-half kilogram concentrated sulphuric acid, 5 grams* cooking salt and 5 to 25 grams sulphate of zinc. The longer the object remains in the pickle, the more matte it becomes. Soldered joints are thus turned black and have to be cleaned off with a brush. The matte pickling depends on the unequal attack of the acid mixture on the material. Although the compounds given are the most common, they are by no means always the best to use. The different composition of copper-zinc alloys often produces, for example, in one and the same pickle, very different color tones, which affect the results of chemical coloring. In order to get the same tone always with the same coloring bath, care must be taken even in the pickling, and the composition of the pickling fluid must be adapted to the conditions.

After each pickling a good washing off with water is absolutely necessary, since remaining traces of acid destroy the effect of pickling. It is therefore advisable to put the article also through a weak solution of sodium carbonate, or lime water. When placed in the pickle it ought to be dry, and the acid mixture must be kept as free as possible from water.

It is often intended to give brass ware a granular surface. For this purpose it is placed for about 24 hours in a preliminary pickle, consisting of one part sulphuric acid, one part nitric acid and eight parts water. This gives it a watery or cloudy appearance. With a yellow pickle that is considerably exhausted, or as a result of long continued pickling, spotted objects are often obtained. Further pickling does not help in this event. In such cases the dry article is dipped in a solution of chloride of zinc and warmed till the solution is dried in and well washed off. The object is then clean. The pickled articles are then either ready to color, or else are first to be placed in pure water, with some tartar.

Iron and steel are pickled white in concentrated nitric acid, to which is added some lamp black. It is very difficult to preserve on castings a surface suitable for coloring. Tempering or annealing, is, therefore, to be recommended. If this is not feasible, pickle with 1 per cent. sulphuric acid; bar iron in 10 per cent. sulphuric acid, while for steel may be used about 20 per cent. hydrochloric acid. Polished steel is pickled in a solution of acid sulphate of potassium. Lead, tin and their alloys are cleaned by brushing off and scouring in clean sand. Aluminum is placed in diluted soda lye, which gives it a brilliant surface. For matte pickling it is placed in strong soda lye till a lively gas development takes place. Afterward it is well washed off and dried. Silver articles are best cleaned from the adhering yellow to dark-brown layer of silver sulphide by warming and dipping in dilute sulphuric acid (1 to 5) or by boiling in a solution of one part tartar and two parts cooking salt; further by cleaning with a rag and a 5 per cent. solution of potassium cyanide.

Gold does not oxidize on the surface and, therefore, needs no pickling. Alloys of gold are rubbed with a rag and about 3 per cent. borax solution. In order to produce a matte surface on gold, it is coated with a melted mixture of eight parts saltpeter, five of alum and seven of cooking salt, is heated and immersed in cold water. In heating it develops chlorine, which eats into the surface of the gold.

The Coloring Proper

If the articles intended for coloring in one of the ways to be described are properly prepared for it, they can be taken in hand directly to undergo the process. We now arrive at our proper subject, metal coloring. This, however, is no general treatise intended to describe all methods. I must, therefore, say little about those processes which depend on the formation of a thin precipitate of another metal on the surface of the metal object, considering them only so far as they are absolutely necessary to individual coloring processes. Thus a light coppering before the coloring proper often proves to be requisite. The coloring in these cases is not on the metal object itself, but on its coppered surface. Since the coloring of copper and its alloys constitutes by far the greatest part of metal coloring, it is in order to consider that subject first, then to follow with the coloring of other metals, and finally to mention a few special processes that are worth considering. To begin with, just before the coloring, it is well to dip the object in a mixture of equal parts of alcohol and water. This removes air bubbles and promotes the wetting with the coloring solution.

(To be continued.)

*1 kilogram = 2.2 pounds.
†1 gram = 15.4 grains.

Making Tracing Cloth "Bite"

By A. E. Lowe

I have often thought that makers of tracing cloth could do something to obviate the necessity of chalking before the ink would bite, but a recent experience has shown me why, perhaps, it is not done.

After cutting up some cloth into the standard size that we use, I thought it would save time if it was all chalked at once, so accordingly had this done. Imagine my surprise when, on using some of this cloth only the next day, I found that the ink would not take and I had to chalk it again. I have since tried some experiments and the conclusion seems to be that the bite imparted by the chalk wears off in about 24 hours. This may be only an isolated case, but I should like to have the experiences of other draftsmen on this matter, when some kinks not generally known may come to light.

While on the subject, I may say that some time ago I had some cloth that defied all the usual means of making the ink bite, and after a good deal of thinking I tried rubbing with pumice powder which did the trick perfectly.

It is estimated by those who have made a study of the sources of water-power of the Appalachian mountains, that there can ultimately be developed from 5,000,000 to 7,000,000 horsepower during the dry season of the year, and a much larger quantity at other times.

The Machinist's Side of Taylorism

By Frank C. Hudson

The way in which the Taylor or any system which attempts to dictate all the details, appears to an intelligent machinist. A denial of the claim that nineteen out of twenty men deliberately try to see how little they can do.

A claim that cutting out responsibility removes ambition, co-operation and is not economical in the long run.

First, let me say that I am a machinist, that the boss says I do more than the average day's work, that I do not believe I earn *all* the money he makes, and that I have no doubt that my efficiency could be largely increased by a scientific time or motion study and that I will gladly help to make it. This ought to show that I am not unalterably opposed to progress and that this is not a screed from a disgruntled individual.

But the more I read of the so called scientific management the more I can sympathize with the opposition that is being developed in some quarters, an opposition which is bound to be misunderstood by men like Mr. Taylor, whose idea of class distinction belongs to the Middle Ages, as is clearly shown in his latest book on the subject.

Are We a Set of Loafers?

The exponents of the new brand of the so called scientific management are very fond of pointing out its advantages to the worker in the shape of greatly increased wages, easier work and generally increased prosperity. But the way in which the worker is considered can perhaps best be seen by a few extracts from the book in question. I quote from one of several similar complimentary references.

"In nineteen out of twenty establishments the workmen deliberately work as slowly as they dare, at the same time trying to make those over them believe that they are working fast."

In other words 95 per cent. of us are deliberately frauds, cheats and bluffers.

His further solicitation for the welfare of the laborer is shown in his almost brutal conversation with laborer Schmidt at Bethlehem, in his endeavor to make him see the advantage of being a "high priced" man and earning $1.85 a day, by doing *four* times the work he did for $1.15. He succeeds in doing this, succeeds in making him carry 35 tons of pig iron for the additional 70 cents, only to reward his faithfulness and obedience by saying "the writer firmly believes that it would be possible to train an intelligent gorilla so that he can be a more efficient pig-iron handler than any man can be."

He also wishes it "distinctly understood that in no case is a workmen called upon to work at a pace which would be injurious to health," but later tells us that only one in eight of the husky laborers at Bethlehem could stand the pace.

Blind Obedience or Co-operation and Responsibility

There is also a mass of contradiction in regard to the position of the workmen. In one place everything is planned for him, every motion is studied out so that he follows a fixed program from morning till night, while on other pages he speaks of securing the "initiative" of the workmen and of how much of the problem is up to them. Initiative and the Taylor system do not and cannot go together so far as the mechanic is concerned, or else the word initiative has taken on a new meaning.

Most manufacturers I know believe that the success of any system depends on the hearty coöperation of the workmen, and that this can only be obtained by considering them as human beings instead of merely cogs in wheels of industry, and I do not see how they can be expected to welcome such statements or such a system with open arms. And the talk of greatly increased remuneration is very apt to sound rather hollow when the worker learns that he is expected to sink his individuality and blindly follow a set pace and program, to increase his output 300 per cent. for a 60 per cent. increase in wages, and, after all that, be told that a trained gorilla would be preferable anyhow.

Going to Extremes and Upsetting Things

As with most innovations, we are too apt to go to extremes, and it is here that our trouble lies. With pushing men like Taylor and Emerson talking and writing of their theories, we are almost sure to have an epidemic of alleged efficiency, which will be disappointing and will, I fear, spoil many of the pleasant relations which now exist in many cases. No man who has his heart in the work, who studies the American Machinist to get new ideas to apply to it, will be overjoyed to have a blueprint schedule handed him, which outlines his every movement from morning till night.

I am perfectly willing to have a fair time limit set for any job and to be told of methods that have been used to do it in this time, but the prospect of doing this job year after year, according to a schedule made up in the planning department, is not at all pleasing to a man who thinks he thinks, whether he actually does or not. When you take away all responsibility you kill interest and both work and man suffer.

I agree fully that the most efficient man should earn the most money without limit, but I also realize that the second-grade man must be considered, that he cannot be allowed to starve, even if he is at fault, which is not always the case. And even Mr. Taylor does not guarantee that the increased effort will always be rewarded by the munificent increase he quotes in the case of Schmidt.

Anything which will cut out loss of time or material is to be warmly welcomed, and the only reason the mechanics sometimes fail to enthuse over it as they should is the lingering memory of savings effected in the past, which have not benefited them in the least. And, whether it is exactly ethical or not, both the employer and the employed like to hear a little of the savings jingle in their own pockets.

The Taylor System's Great Defect

The great defect of the Taylor system is the attempt to make all men in the same mold and to do work in exactly the same way. Such a plan cannot fail to kill initiative and ambition, which even his alleged increases in pay would not offset. It would develop a race of automatons, who, having ceased to think for themselves, would be easily led by any agitator, and I do not believe the results would please even Mr. Taylor in a few years. It is for this reason and not from either laziness or a desire to defraud the employer, as has been intimated in the book mentioned, that mechanics generally do not favor his plan.

Mr. Taylor has done much that is commendable, his time study will undoubtedly give good results, but his latest utterances breathe class distinction more strongly than ever, cast unwarranted reflection on the honesty and intelligence of the average mechanic and can hardly fail to rouse bitter antagonism in every quarter. This, unfortunately, will be misconstrued by many as a desire to block progress instead of an attempt to preserve the individuality which I believe, has made this nation what it is today.

There is no question as to the possibility of improving our general efficiency, but we as a nation of workers cannot afford to pay too heavily to secure it.

Building Clay Working Machinery

Western Correspondence

Some unusual methods in machine construction as applied in the plant of a well known builder of equipment for the manufacture of brick, hollow ware and other clay products.

Features of machine design that enable certain parts to be assembled with little or no machine work. The use of hexagonal shafts for driving clay-working knives and other parts without keys and set screws.

A new shop building with points of interest, and a variety of special tools and machining processes.

Probably very few readers of this journal are familiar with the details of modern clay-working apparatus, or with the methods under which it is constructed. The demand for such machinery compared with, say, machine tools, is not extensive, for one set of equipment can produce an enormous number of bricks, tiles, or similar objects of clay, in the course of a ten-hour day, and this means that in most cases the machinery for such products is built in fairly small lots, making it, as a rule, impracticable to adopt the special manufacturing processes that would be economical if the machine parts were put through the shop in large quantities.

There is, however, another feature peculiar to this line of industry, which, to a certain extent, offsets the disadvantage of carrying the work along by individual, or limited numbers of machines; that is, in the construction of much of the apparatus, a relatively small amount of machine work is required, so that after all, the total time and effort expended in the setting up and tearing down of the different short jobs going through the machine tools for any given clay-working machine, may not prove serious items when the entire proposition of getting the machine parts through the foundry, and fitting up and erecting the apparatus, is taken into consideration.

A New Shop for This Work

The C. W. Raymond Company, for many years established in Dayton, Ohio, as builders of machinery for the production of brick of various kinds, hollow ware, pottery, etc., has recently erected a machine shop and foundry, in which numerous operations and methods of interest may be seen. The shop itself is well illustrated by the halftone, Fig. 1, which represents the interior of the structure, for perhaps two-thirds of its length.

The building is 320 feet long by 88 wide, and is of brick and steel, with concrete floor and clay-tile roof. The main bay, which is 38 feet wide, is served the whole length with a 10-ton crane, and at either side is a gallery 25 feet in width, a portion of one gallery being utilized for pattern storage, while the opposite gallery is fitted up for wood-working shop, pattern shop, drawing room, etc. A number of the heavier tools are visible in the engraving, along either side of the main aisle, and the general character of the work is indicated by the castings and

Fig. 1. General View in the C. W. Raymond Company Plant for Building Clay-working Machinery

forgings seen on the floor through the length of the shop.

Facilities for Handling Material

At one end of the building a railroad track admits freight cars directly into the plant, and an industrial track which extends the full length of the shop, connects near the middle of its length with a track leading in one direction to the foundry, and in the other to the elevator for the pattern storage. It should be noted that, owing to the fact that the building was hastily occupied and before actual completion, during the winter months, a number of features, including the arrangements of tool room, stock room and the general disposal of material of various kinds, are not as yet permanently established.

The shop is lighted and operated by electric current, and in most instances the tools are grouped in ten-horsepower units. This divides the machinery into small groups (in some cases there are only one or two tools on a motor), and the expectation is that owing to the fact that many rush jobs and overtime operations have to be attended to, there will arise occasions when it will be an advantage to be able to interchange motors; that is, if a motor should become disabled on a certain group of machines working independently of the shop in a special instance, it will be feasible to replace it at once with another motor which happens to be idle at the time.

A feature which is quite unusual is the fact that the entire supply of brick for the walls and tile for the roof was manufactured upon machinery built by the firm itself.

A Heavy Grinder

A number of clay-working machines in whole or in part are shown in the different engravings in this article, and one, known as a "dry pan," is seen in process of erection, in Fig. 2. This machine is used in grinding and pulverizing clays and similar materials, and operates upon the principle of two rollers (called "mullers") which crush the material that is carried beneath them by a revolving pan with a screen plate forming its bottom.

The rotary pan with its screen plate is driven by bevel gears acting upon the vertical shaft, and the two rolls are mounted upon horizontal shafts which are guided at the outer ends in bearings that fit vertical slots in the uprights, while the inner ends are connected by an open yoke which allows the vertical driving shaft to pass down through the pan to the step bearing and at the same time permits the rolls, with their shaft and yoke, to rise and fall freely, according to the action of the material which is carried under them in the reduction process.

The Crushing Rolls

The mullers are very heavy, weighing in the case of the machine illustrated, about three tons each, and are of gray iron with chilled-iron tires. They have a face width of about ten inches and the tires on each are in the form of two rings placed side by side upon the body. This split construction permits the two halves of the tire to be transposed upon the muller when in the course of time they become worn near the edge, and this alteration then brings the former outside edges of the two rings into contact with each other over the center of the muller body.

The tires are about one inch larger inside than the outside diameter of the cast-iron body and are secured in place by oak blocks driven between the tire and casting, with iron wedges driven into the blocks, and by through bolts from side to side, as shown in Fig. 2. The bolts pass through cored pockets and the only machine work necessary in mounting the tires is the grinding of the chilled edges of the two tire rings to allow them to abut against each other with a satisfactory joint.

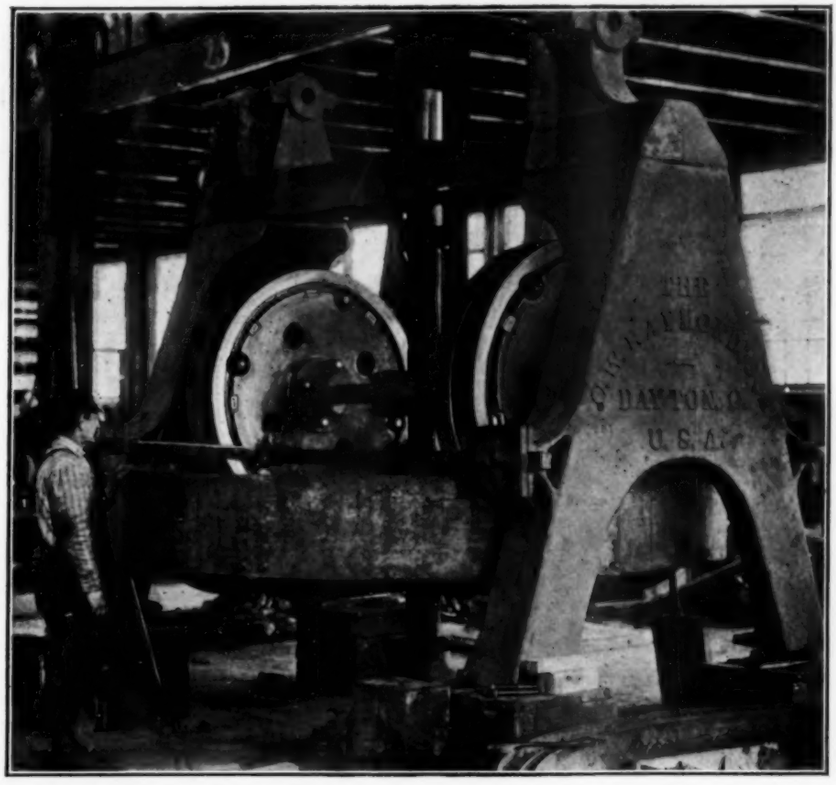


Fig. 2. "Dry Pan" Under Erection

A Step Bearing

The load upon the step bearing is approximately 20,000 pounds, and the bearing is of the form shown by Fig. 3. The part *A* is a hardened steel member which is attached to the lower end of the vertical shaft and revolves upon the hemispherical, phosphor-bronze step *B* which rests loosely in the step box. *B* is slotted at right angles to facilitate the circulation of oil over the bearing surface. An oil reservoir is formed at *C*, directly under the main bearing *D*. The packing gland is shown at *E*; the front plate at *F*; the base plate at *H*. The latter rests upon the foundation and the set screws allow the step bearing to be adjusted in any direction.

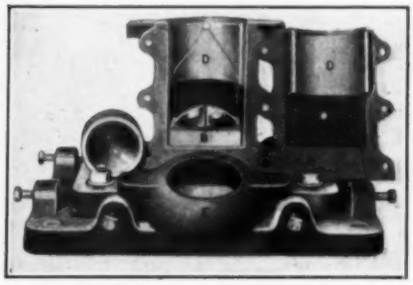


Fig. 3. Dry-pan Step Bearing

Machining Friction Spiders

A type of friction used on "dry pans" and on some other machines built by this company, has a spider of the form illustrated in the lathe, Fig. 4. In machining this spider it is gripped in the four-jaw chuck, and while the hub is being roughed down the casting is further secured by a bolt passing through the cored hole and through the hole in the spindle. This bolt is removed for the boring operation in the hub and after

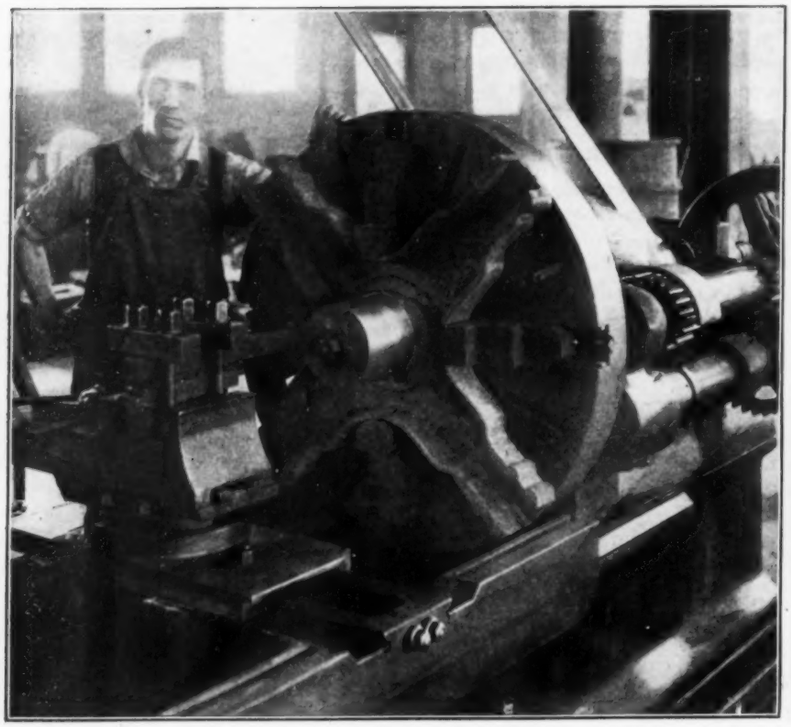


FIG. 4. TURNING A FRICTION-SPIDER HUB

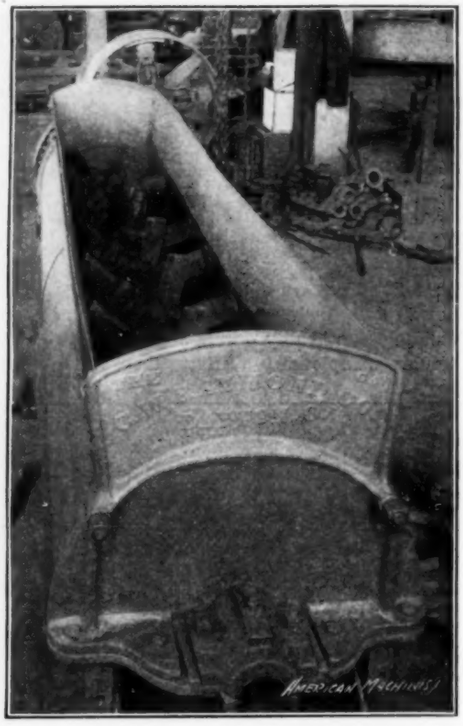


FIG. 5. INTERIOR OF A "PUG MILL"

that the finishing cut is taken on the outside of the hub.

"PUG MILL" WORK

The interior of a "pug mill" for mixing and tempering clay, is illustrated in Fig. 5. This is an interesting example of a machine in which a considerable number of parts are assembled upon a shaft without machine work.

The main shaft is hexagonal in section, for the greater portion of its length, but is, of course, turned down at the ends for the bearings. Upon this shaft are mounted a series of cast-iron hubs for holding the blades which mix and temper the clay. The hubs are in halves as shown in Fig. 6, with openings in the wings to receive the blades, and an inspection of the parts in the engraving will show that when the two halves of the hub are placed upon the shaft and the blades are in place, the assembled unit is capable of holding itself together, due to the way the hub castings and the blades (which are also castings) interlock.

In actual practice two bolts are put through the cored holes in each pair of hub castings and blades, to prevent the blades from working out endwise; but even without these bolts the hub halves could not swing apart, for the blades key them together by fitting half their thickness in each hub. Also, the method of offsetting the wings on the lugs so that one fits over and one under the wings of the other half of the hub, would prevent the two parts from drawing apart sidewise, even though they were not confined

FIG. 6. HUBS AND BLADES FOR "PUG" MILL FOR "TEMPERING" CLAY

FIG. 7. "AUGERS" AND OTHER CASTINGS FOR BRICK MACHINE

against end movement by the other hubs on the shaft. The necessity for set screws for keys and driving is also eliminated by the hexagonal shaft.

It is customary to use one straight blade and one angular one in each pair of hubs, as indicated in Fig. 6. The straight blade merely shears through the material; the angular one imparts a lateral movement to the mass, and the amount of kneeding given the material and its rate of passage through the machine may be varied to suit requirements,

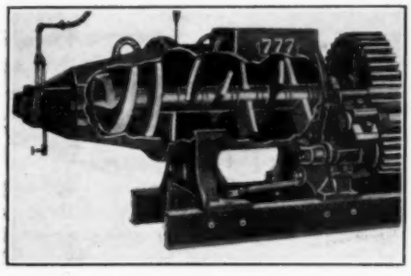


FIG. 8. INTERIOR OF BRICK MACHINE

by utilizing blades of the requisite degree of angularity.

OTHER PARTS NOT REQUIRING MACHINING

Fig. 7 represents a group of castings, most of which are used in brick-making machines. These castings are mostly "augers," "auger wings" and "pugging knives," used on a hexagonal shaft in a cylindrical casing for working the clay and pressing it through dies at the end of the chamber, from which the material emerges in a plastic column or bar which is automatically cut up into brick ready for drying and burning.

A section of the interior of a brick machine is illustrated by Fig. 8, which shows the arrangement of the knives and auger upon the shaft, with the die at the end for the shaping of the clay bar as the plastic substance is forced through it by the action of the auger. The shaft is rotated by powerful gearing and the driving of the auger and knives is accomplished by the hexagonal section over which the cored castings are fairly close fits.

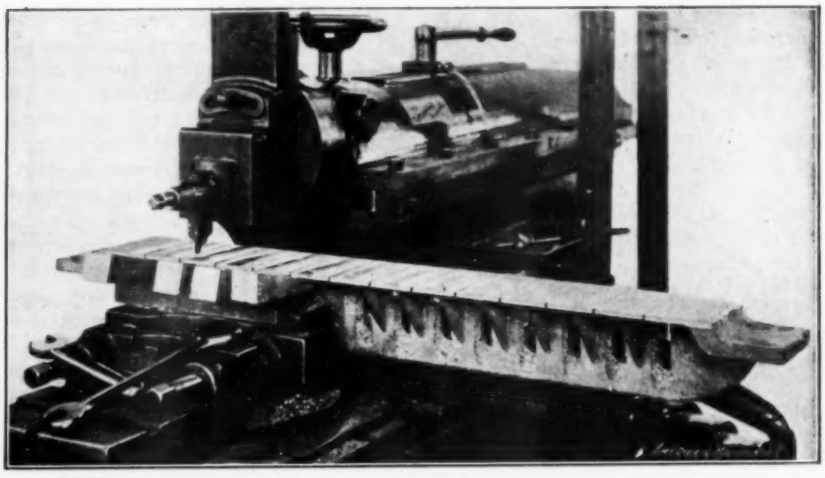


FIG. 9. CUTTING SLOTS IN "BACK BOARD" OF BRICK-CUTTING MACHINE

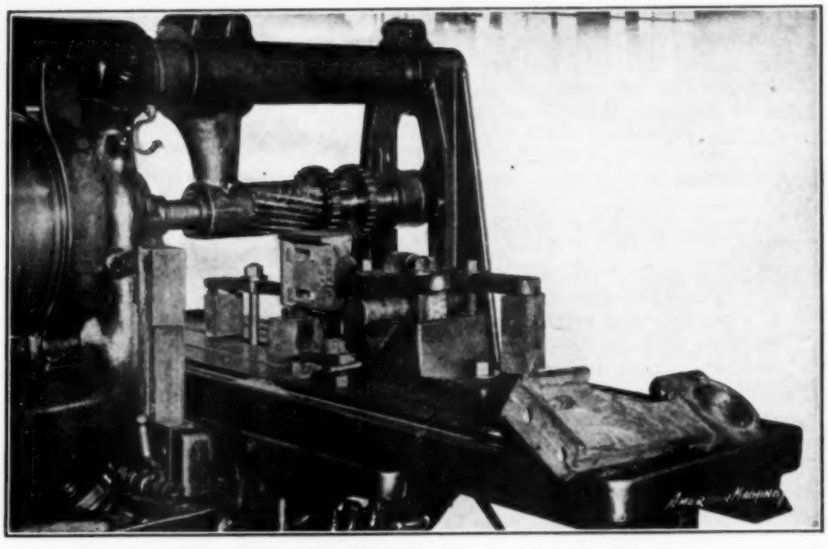


FIG. 10. MILLING HANGERS FOR CUTTING MACHINE

AUGERS, TEST SHAFTS, ETC.

Some of the "augers" are nearly 2 feet in diameter, as indicated in the halftone Fig. 7, where a 2-foot rule folded in the middle is seen leaning against one of

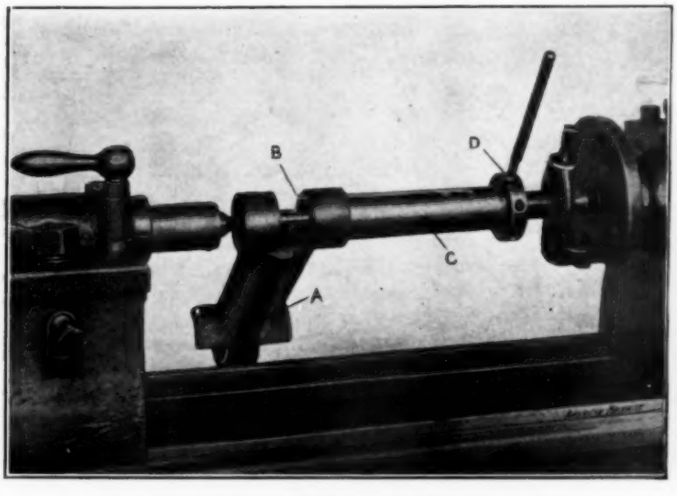


FIG. 11. SPECIAL FACING TOOL IN THE LATHE

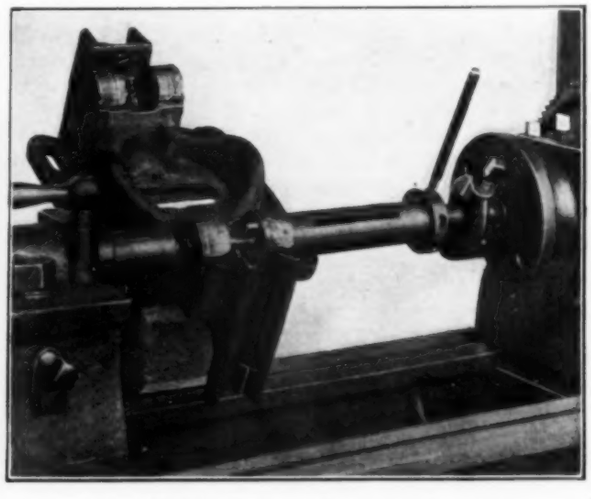


FIG. 12. FACING TOOL IN ANOTHER OPERATION

these castings in the background. In the group will be noticed several short pieces of hexagonal shaft with one end turned down to cylindrical form. These are cut off from regular shaft stock and used as gages to determine if the cored holes in the work will admit the shaft that is to be used in the brick machine. The reduced end of the hexagonal plug is used to test the round-cored hole at the end of the hexagon in the augers. The small end of the shaft is tapped and a cap screw and washer applied as in Fig. 8, to hold the castings in place endwise on their shaft.

The piping leading to the dies in Fig. 8 permits either steam, water or oil lubrication of the dies, according to requirements.

At the right-hand side of Fig. 7, several castings will be noticed, having square cored holes instead of hexagonal openings. In some cases in this line of manufacture, square driving shafts are used and the castings mounted thereon are carried in the same manner as on the hexagonal shafts.

A Slotting Job in the Shaper

The cutting machines referred to in connection with the brick machine consist of a swinging frame work with a series of music wires which are swung through slots in a casting upon which the plastic clay bar is fed as it comes out of the die. The automatic cutters of this type sever 10 bricks and each pass of the wires through the material, and the output is limited only by that of the brick machine.

In another type of cutting machine the wires are given a shearing movement down through the slots in the table and back again, and a "back board" for such a table will be seen in Fig. 9, in the shaper vise, where the slots are being cut with the square-nose tool. The casting is naturally inclined to spring enough to seize the tool as each cut is made, and to prevent this, wood wedges are inserted under these sections immediately adjoining the one being slotted.

A Milling Operation

In some of these brick cutters where the wires are carried by a revolving frame, the table sections are independent of each other and consist of a series of parallel blocks far enough apart to allow the wires to sweep through between their edges. The sections are carried by hangers mounted upon the central shaft, and two of these will be noticed on the table of the milling machine, Fig. 10.

After the hole for the shaft has been bored in the hanger and its cap, and the metal faced off around the hole, the hangers are placed in the fixture, Fig. 10, and the bearing face machined flat and the edges straddle milled. The casting is held on a plug resting in a V-block, and the outer end is blocked up level. Three straps hold the work in place.

These hangers are made in a variety of widths and to avoid the necessity of a separate slabbing cutter for each width the gang is arranged with the slabbing mill outside the pair of straddle cutters, and one cut is taken in facing the work and a second pass made for milling to width. This means moving the table in and out for each piece handled, but owing to the limited numbers of pieces put through at a time, the shift from one position to the other causes very little loss of time even on the entire lot, and the method is certainly more economical than removing the work after the first cut and resetting it in the fixture for the straddle milling after the passage of the entire lot through the first operation.

Facing Tool for the Lathe

Two illustrations of a special facing tool at work in the lathe, are presented in Figs. 11 and 12. In both instances it is shown in operation upon the inner faces of bosses on castings, and it is in fact, designed for these inner or back-facing cuts.

In Fig. 11, the casting to be faced between the bosses is a toggle arm *A*, which has already been bored to size and finished on the outer faces. The inner facing tool *B* is carried in an arbor which also carries the sleeve *C* and which is a running fit in the hole bored in the work. The arbor is threaded for the nut *D*, which bears against the end of sleeve *C*, and this nut is actuated by the pin to force the sleeve and work toward the tailstock, thus feeding the casting against the facing cutter *B*.

The sleeve is slotted and a pin driven into the arbor connects the sleeve to the latter, so that with the lathe spindle in operation, everything about the tool revolves except the work, which rests against the front of the lathe bed. The tool rotates so slowly, however, that the operator has no difficulty in inserting the pin in the nut *D* to feed the work to the cutter.

The operation on the larger casting in Fig. 12 is performed in a similar manner. To show the tool and work clearly the front of the casting was blocked up before the photograph was taken; ordinarily the casting rests upon a thin block in the lathe shears.

The War Against Loan Sharks

A recent decision of the appellate term of the New York Supreme Court in the case of Thompson versus Gimbel Brothers marks an important step in the progress of the crusade against the salary-loan sharks in New York. Employees of Gimbel Brothers, having borrowed money at rates of interest from 175 to 390 per cent. per annum on small loans, failed to make subsequent payments demanded by the loan company. The employees' wages were filed upon, but Gimbel Brothers refused to recognize the file. The loan company brought suit against the firm, and the appellate term has ruled that the loan company has no valid right to the wages of the employees. This court has granted leave to appeal to the appellate division, and the decision of the latter court is awaited with much interest.

Many employers have rules forbidding employees from assigning their wages for loans under penalty of discharge. This attitude has furnished the loan companies with adequate security for their loans. It is gratifying to note the recent change in the attitude of several large employers in this respect. The Retail Dry Goods Association, which employs more than 50,000 men and women, has recently voted to rescind the rule of discharge, and in the future deserving borrowers will be defended from paying illegally high rates of interest. Similar action has been taken by several publishing houses, at least two railroad companies, a large telegraph company, several insurance companies and many smaller employers.

The decision of the appellate term in the case defended by Gimbel Brothers sustains the contention of the Russell Sage Foundation that in their present practices the salary-loan companies have not complied with the Personal Property Law, and for that reason employers are not required to recognize the assignments upon borrowers' wages.

Many employers are recognizing the need for temporary loans among small wage earners, and providing an opportunity for them to borrow in time of pressing need. The firm of Gimbel Brothers is following up their defense of employees by establishing a loan department of its own which will advance money to anyone on the company's pay roll whose case is proved upon investigation to be worthy. Constructive measures of somewhat similar character have been undertaken in several other cities, notably by the Celluloid Company, of Newark, N. J., the Gorham Manufacturing Company, of Providence, R. I., and the Filene Stores, of Boston.

The Italian government is taking up the pneumatic-tube postal system and three are being built in the cities of Milan, Rome and Naples. The first is practically completed and will be in operation in a very short time. It is nearly four miles long, but is not as extensive as the one to be installed in Rome. Both compressed air and vacuum will be used, the tube being about 3 3/16 inches inside diameter. The compressors were made in Germany and will be driven by electric motors, which are installed in duplicate, so as to hold one in reserve and avoid delay. In the beginning at least the tubes will only be used for telegrams and special delivery letters and later the system will be extended.

Making Livingston Radiators

By Ethan Viall*

A novel radiator and a special automatic machine for making the cooling tubes.

Details of the seaming mechanism.

Jig used for assembling radiator tubes and method of soldering the seams and binding of tubes together.

Testing for leaks and the final soldering.

*Associate editor.

There are a large number of radiators on the market of various types, which include the tube-and-fin, the honeycomb and many other forms, but there is none more interesting, from a mechanical standpoint, than that manufactured by the Livingston Radiator and Manufacturing Company, New York City.

The Livingston radiator is composed of a number of vertical and horizontal "tubes," with square corrugations, each tube being made up of two strips of thin, square-corrugated metal, swaged to form water spaces, and the edges lapped or bent over to form a seam, the tubes being formed in a machine, built especially for the work by the E. W. Bliss Company, which takes two strips of metal the proper width, corrugates, swages, combines the two strips and laps the edges, in one continuous series of operations.

In order to give the reader a clear idea of the actual construction of this type of radiator, *A*, Fig. 1, shows a piece of copper cut off of a strip; *B*, a piece of a radiator with a part cut away to show how the water channel is shaped, while at *C* are two strips partly torn apart.

The automatic machine in which the radiator tubes are formed is a most interesting machine, which is in reality three machines combined in one; that is, two punch presses and a seaming machine. This automatic machine is shown in Fig. 2, and the forming, corrugating and swaging punches and dies for each strip are shown at *A* and *B;* the rolls of copper at *C* and *D;* the seaming machine at *E*, and the completed "tube" which comes from the machine at *F*.

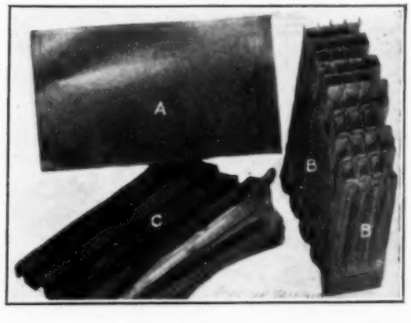


FIG. 1. SHEET OF COPPER AND SECTION OF RADIATOR, SHOWING CONSTRUCTION

A larger view of the forming, corrugating and swaging punches and dies is given in Fig. 3, the letters *A* and *B* corresponding to those in the previous halftone. Little explanation is needed for the work performed by these punches and dies, except that the first punch has a rounded face which forms the strip into a loop sufficiently large to allow for square-corrugating and swaging by the following punches without tearing the metal; a cam motion doing the feeding, but in Fig. 4 the details of the seaming machine are plainly illustrated, the upper part being swung back to give a clear view of the bending punches, which work from both sides of the strips at once. It will be observed from the illustration that the upper strip is narrower than the lower, so that the ends of the corrugations on the lower strip may be bent up over the upper ones to form a seam. The view shown is slightly distorted on account of the position from which the picture was taken, but the punches *A—A* bend over the top and bottom ends of the square corrugation where indicated by the arrows, these ends having already been partially bent up in the forming die of the lower press. Punches *B—B* bend the side pieces in slightly while punches *C—C* push the partially bent ends in toward the inside of the square corrugation, completing the bend, the arrows indicating the work of the punches in each case.

The part *D* of the upper piece works freely between the feed teeth *E—E*, and is pressed down onto the work by springs when in position, the feeding being done by a cam lever which works the top *F*, back and forth a distance equal to one full corrugation at each stroke, the bottom plate directly under the teeth working automatically up and down in order to give the feed teeth a chance to take hold.

As the formed and seamed strips come from the automatic machine, they are cut by hand into the proper length for the formation of the radiator for which they are intended. These strips are then

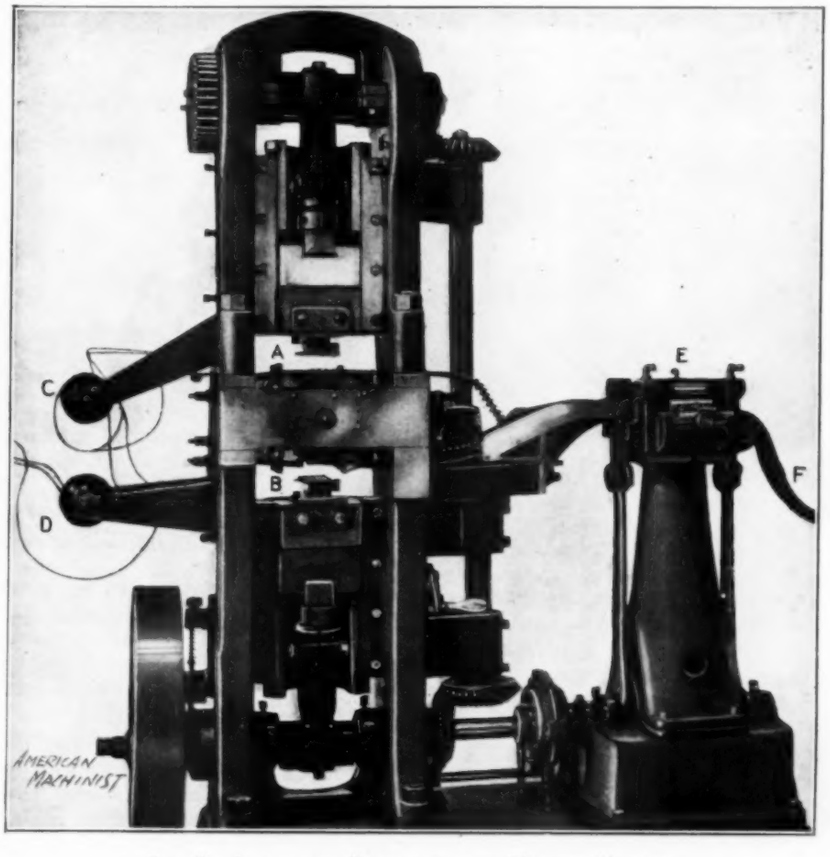


FIG. 2. AUTOMATIC RADIATOR-TUBE MAKING MACHINE

wedged into a comb jig or nest, shown in Fig. 5, which is pivoted in a fork so that it can be easily turned, the entire arrangement being suspended from an electric hoist. After the pieces composing the radiator have been securely wedged in position, the jig is turned over so that the radiator faces downward, and the edges are then dipped for about ¼ inch into melted solder, which immediately closes all openings, makes the seams water tight and binds the tubes into a compact cluster. As soon as one side of the radiator has been dipped in the solder it is removed from the jig and the other side dipped into the solder by hand.

Fig. 6 shows one of the radiators which has been dipped on both sides, and at the left, in the same halftone, is shown a part of the solder tank, which is heated by gas burners.

In Fig. 7 is shown the simple way in which these radiators are held, while the edges are soldered by hand, preparatory to the placing of the frame. These frames are cut and formed on machines similar to those used in any ordinary tin shop, and the parts are then soldered together, as shown in Fig. 8.

In Fig. 9 one of these completed frames is shown being placed around a radiator, after which it is again gone over with a soldering iron and securely attached.

In order to be sure that the radiators do not leak and will stand the pressure for which they are intended, they are carefully tested at an air pressure of 15 pounds, which is more than ten times the pressure that they undergo in actual service and one of these radiators is shown attached to the air hose in Fig. 10. After the air pressure is put on, the radiator is dipped into a water tank and carefully watched for bubbles and wherever a leak is indicated, it is carefully soldered, using either a small blow torch, such as are shown hanging at the side of the furnace, or else an ordinary soldering iron.

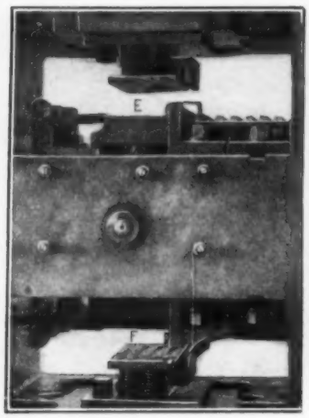


FIG. 3. FORMING PUNCHES AND DIES

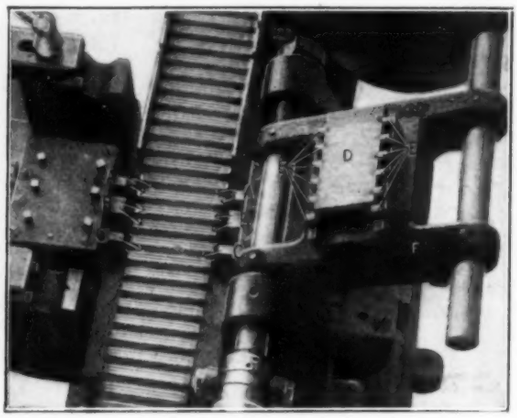
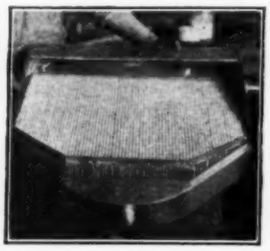
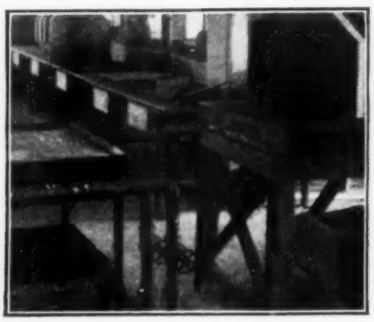


FIG. 4. SEAMING PUNCHES AND FEEDING TEETH



FIGS. 8, 9 AND 10. ASSEMBLING, SOLDERING AND TESTING METHODS



FIGS. 5, 6 AND 7. METHODS OF HANDLING PARTLY FINISHED RADIATORS

Bar Straightening Press

A very neat method of straightening round bars is shown herewith. This consists primarily of a substantial punch press which is set to run continuously, and which has an attachment consisting of a pair of rollers at each end on which the bar to be straightened revolves. One pair of rollers is driven by the round belt as shown from shafting overhead, but these rollers are only in action when the treadle *T* is pressed down by the operator, this action raising the rollers up under the bar and raising the bar free from the support of the press itself.

As the bar is revolved by these rollers the high spots are marked and by simply releasing the foot treadle the rollers drop out of the way, leaving the bar resting on the frame of the press. The bending block or wedge *B* with its convenient handle, is then pushed in between the high spot on the bar to be straightened and the ram of the press which is running continuously. The distance this wedge is pushed in determines the amount of pressure brought to bear on the bar, and the operator soon becomes very skilled in handling this work.

The ease with which the bar can be revolved to show the high side, and the rapidity with which it can be straightened by a careful manipulation of the wedge, makes it a very convenient and economical machine. This is in use in the shop of Curtis & Marble, Worcester, Mass.

BAR-STRAIGHTENING PRESS

Organization of Industrial Schools

By Dexter S. Kimball *

Four stages of purposeful education intended to prepare for productive industries are outlined: That of general or liberal training; that of training in specific fundamentals; that of training in specific technical studies; that of practical application and adaptation.

The second stage of this training for trade and industry lies in intermediate industrial schools.

"If the employer, generally, will rehabilitate the apprenticeship system and make it as effective as the rest of his plant; if he will shoulder again a portion of the load he has endeavored to put upon the schools, where it has no place; if he will take well prepared material from these intermediate schools, I believe a large part of the problem may be solved."

In a former article† it was noted that two of the most important questions regarding industrial education are:

(1) To what extent is it possible to give practical trade instruction in organized schools?

(2) Shall the new industrial schools be formed by remodeling our existing schools or shall they be differentiated from them?

In this preceding article the first question was discussed in full, and the second only sufficiently to make the argument complete. In the present article it is proposed to discuss the second question more fully.

The conclusion was arrived at that it was not only possible to give a certain portion of the required trade instruction in organized schools, but also that for best results these schools should be under *public control*, an integral part of the *public school system*. I am well aware that this point is not conceded by many men who have both thought and *worked* over this problem, some contending that the schools to be effective must be conducted entirely in the atmosphere of the shops, or at least by some form of cooperation between schools and factory. The advocate of such systems overlook the facts brought out in the previous article, that there is a certain preliminary portion of industrial training which can be given *better* and more *economically* in organized public schools, and a system of industrial schools entirely under the domination of factory influence, if effective, would set the line of demarkation between general instruction and special training too early in the life of the child to be in accord with modern concepts of education.

This idea has been well brought out by Mr. Prosser, deputy commissioner of education of the State of Massachusetts in his paper on "Evening Industrial Schools," read before the last convention of the Society for the Promotion of Industrial Education, in which he points out that up to the time of entering the trade, the school atmosphere should predominate; but after entering the trade any further instruction, as in continuation schools, should be dominated by the *shop* influence.

It is freely conceded that many shop schools are doing excellent work, and are, in many cases, perhaps, the best solution at hand, and the same remark applies to all earnest efforts to solve the problem. But it is a great mistake to argue that because certain kinds of schools have been successful under certain environments, that such types of schools *per se* offer the general solution to the problem; and at present, as far as I am aware, no coöperative or shop-controlled school has been devised which offers vocational instruction *on an equal footing* to all children, even up to 16 years of age, to say nothing of *trade training* beyond that point. Any form of school which is dominated in any way by private interest will necessarily be *selective* in its operation and fail to provide for the less intelligent and less skilful child, which really needs such instruction the most. It is difficult indeed to conceive of any general solution of the problem which is not *based* on the public-school system. On the other hand, no system of public instruction can be fully effective which does not have the support and coöperation of the surrounding industries.

If it be granted then that our hope lies in the public-school system, the question naturally arises, how shall these industrial schools be formed? Shall we establish new types of schools or shall we rearrange the existing schools?

Those who favor the establishing of new and separate types of industrial schools are prone to point out the weakness of our present system and in this they have, perhaps, just cause for criticism. In Fig. 1 is shown diagrammatically the system of schools as they exist in most States. Curve N shows the average number of children in each grade from the first to the twelveth, on a basis of 1000 entering the first grade for 386 cities in the United States.* It will be found to agree closely with the figures given by Barker for the city of Cleveland and quoted in the former article. Curve M shows the normal decrease in the size of the several grades up to the eighth, due to the normal death rate and also to the increase in the lowest grades due to increase in population. Thus with 1000 entering the first grade (represented by AO), we should expect in an average city to find 870 (represented by BD) *leaving* the eighth grade. In reality we find about 200 (represented by CD).

Now, statistics show that there are nearly as many pupils of 13 and 14 years of age in the grades below the eighth as there are of any other age. That is, many children become 14 years of age long before they complete the grammer grades and since they are no longer required by law to attend school they drop out, in many cases through lack of interest in the work. On the basis that all children should complete the first eight grades, which is the popular supposition, the efficiency of the primary and grammar grades is,

$$\frac{CD}{BD} = 25 \text{ per cent., about.}$$

It is very evident that a great work must first be done in making these lower grades fully effective. *Every* child should complete the first eight grades. For the trades are, and of necessity must always be, fed from the lower school grades, and educational methods which have trade training as their objective point belong also the the early years of the pupils' school life, and should be based on a general training equal at least to that obtained in the grammar schools. A discussion of the remedies for this very serious defect is, however, outside the scope of this article. It should be specially noted that the trouble cannot be remedied simply by *raising* the *compulsory age limit*. The problem is to make the work of these grades more *effective*.

The advocate of the independent in-

*Professor, machine design and construction, Sibley College, Cornell University.

†"Industrial Schools and Apprenticeship." Volume 33, Part 2, page 958.

*See Laggards in Our Schools, by L. P. Ayres.

dustrial school is also likely to point out the failure of the manual-training high school to turn out well equipped artisans.

Statistics show that only 52 out of every 2437 graduates of manual-training high schools become mechanics and that the great majority fill higher positions in the industrial field. This is as is should be and is in exact accordance with the theory advanced in the preceding article (page 958) and illustrated by Fig. 1 of that article, namely that the scientific background which the boy obtains is, in general, a measure of the hight to which he may rise. Any vocational training given at the ages covered by the high-school curriculum must be of a different character to fit for the trades than that offered by manual-training high schools.

(4) The stage of practical application and adaptation.

The Stage of General or Liberal Training

Every people during its progress has developed certain ideals and standards of civilization which it believes every member of the community should conform to for the protection of the individual, for the protection of the community, and for the preservation of civilization itself. Thus we hold it to be essential that *everyone* should be able to read and write and have some knowledge of the country in which we live. Now, experience has shown us that while the parent, the home surroundings, the press, etc., ***show that vocational training without a liberal background is deadening just as liberal education without some vocational direction is apt to be ineffective and fruitless.***

This minimum requirement of liberal or general education has steadily advanced with the growth of civilization, and the complexity of existence. At present all agree that every boy and every girl should have at least a grammar-school education and that no boy or girl should be admitted to the industries without this minimum requirement; and the general tendency, always, is to extend this limit so as to cover more and more fundamental training. The general idea of the content of this fundamental training has, however, changed very slowly

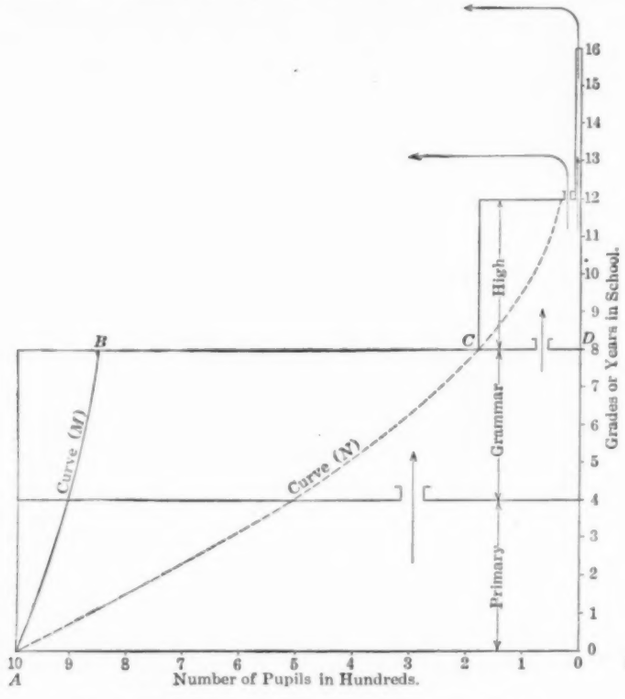


Fig. 1. Diagram of Prevailing School System

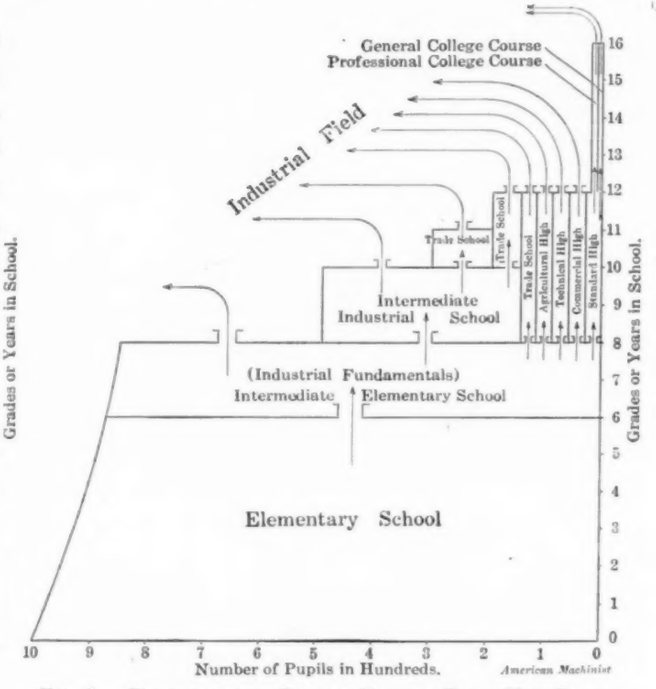


Fig. 2. Diagram of a School System That May Be in Use in Many States in the Near Future

When we come down into the grammar and elementary grades the problem is not so simple, and it is not easy to see how far down the line of demarkation, which is so clear in the high-school grades, should extend. The question as to when general education should cease and special education begin brings up the whole question of what constitutes general education and leads one to inquire into the philosophy of education itself.

All forms of *purposeful* education, and especially those forms which are intended to prepare for the productive industries, consist of four distinct stages which are more or less clearly defined.

(1) The stage of general or liberal training.

(2) The stage of training in specific fundamentals.

(3) The stage of training in specific technical studies.

will supply a certain amount of this fundamental training in many cases, they cannot be depended upon to supply it in *all* cases. We therefore long ago took out of the hands of parents and private interests the teaching of such fundamentals as could be classified and taught in organized schools, and *have made attendance in these schools compulsory* up to the period which public opinion has set as a minimum requirement for the public good.

Where we attempt to educate beyond this point even for strictly vocational purposes it has been found necessary to also carry forward this liberal side of education, extending it to cover not only a wider knowledge of our own country and its history, but to a knowledge of other countries and their history, language, etc.

All educational experience goes to and in most places it still consists only of those studies which are considered essential to good citizenship; namely, reading, writing, geography, etc.

Experience in education has led us to make a somewhat different classification of many studies as far as distinguishing between so called liberal and so called vocational studies is concerned. It is now generally conceded that what is a vocational study for one man may be a liberalizing one for another. Music, for instance, is vocational for the paid performer and cultural or liberal for the engineer; chemistry is vocational for the industrial chemist and liberalizing for the student of languages. It may be, therefore, that certain studies which were formerly considered vocational only, may even now be liberalizing in their effect and should, perhaps, form a part of the minimum requirement of such studies.

Now, the studies included in this minimum requirement in almost all school systems and which have for their primary purpose the development of intelligent citizenship have had till now, little or no bearing on industrial matters or on the problem of making a living. Yet all men who have looked into social and industrial evils tell us that good citizenship depends more on ability to make a living than upon any one other factor. The commission on Industrial and Technical Education of the State of Massachusetts says in its report, "The latest philosophy of education reinforces the demands of productive industry by showing that that which fits a child best for his place in the world as a producer tends to his own highest development physically, intellectually and morally."

The great business of all the more civilized nations today is industry and almost all our great national problems center around the industrial problem. Intelligent citizenship is not possible, therefore, without *industrial intelligence*, and this can only be evolved by incorporating in the minimum training required of every boy and girl those fundamental studies which will lay the foundation for such intelligence. This has been definitely recognized in the New York State syllabus of the year 1910, which divides the required eight years of school attendance into a six-year elementary course, and a two-year intermediate course. Drawing and elementary handwork form a continuous course in the first six grades and are alike for all pupils. More advanced work in these subjects which underlie industrial intelligence is given in the seventh and eighth grades, with the additional feature that a certain amount of differentiation in subject matter is introduced, this differentiation recognizing first the difference of *sex*, and secondly the difference in *taste* of the pupils. Some of the reasons given for the introduction of these features and which are worth noting are:

"To develop appreciation for industrial work by showing through actual experience that it means mental as well as physical fitness."

"To command respect for the labor of the artisan who is supplying the material demand of the public, and who needs the intelligent support of the community in securing his economic and social rights." and—

"To give the best possible start toward the life work in which the pupil will be most content and most efficient."

The syllabus distinctly disclaims that either trade training or even a choice of vocation is premeditated by this work. The aim is clearly for industrial intelligence, and recognizes also the great cultural value of properly correlated hand work. It is, in my opinion, the best statement of what the scope of the elementary schools should be, as far as industrial training is concerned, that has been made, and certainly marks progress.

The Stage of Training in Specific Fundamentals

At the base of every profession or trade lie certain bodies of knowledge, which in most cases, are common to several professions or trades; and of which it is desirable that all workers in a given group of professions or trades should have some knowledge in order to fully appreciate the relation of their own specialty to allied callings. Thus civil, electrical and mechanical engineers must have a knowledge of chemistry, calculus and the fundamental laws of physics; and these are usually taught to all alike without reference to any one of these specialized branches.

Again the prospective patternmaker should know something about machining and molding; and the student of modern languages studies Latin and Greek as a foundation for his future specialty. In some cases manual skill may form one of these fundamental requirements.

In the professional schools of university rank these fundamentals are well defined, especially where marked differentiation has occurred in the group, as for instance, in the engineering colleges. They are not so well marked in the high schools, as yet, for the high school has not as yet fulfilled its complete place in our educational system by preparing students for their life work as well as for college. But with the coming of new forms of high schools which will have as their avowed purpose the training of men and women for life work the fundamentals which lie at the base of the several walks of life, for which preparation is being made, will be more clearly defined and more carefully thought out. For the boy or girl who can and will go to the high school either to prepare for college (for this function must be retained) or to prepare directly for the industrial field, facilities are at hand, or very shortly will be, and they may be omitted from the discussion.

For those who must go into the trades and industries, and they are the great majority, not even this much has been provided. For these the intermediate industrial schools, referred to briefly in the previous article, have been proposed and in them seems to lie great promise. In them it is proposed to teach such fundamentals as lie at the base of a *group* of trades if such fundamentals can be found. They would receive pupils of not less than 14 years of age and would have for their primary object the assisting of the boy or girl to make an intelligent choice of a calling and the laying of a foundation for the same. They would not lead to either high school or college but to the industries. They would bridge over the wasted years between 14 and 16 and give a portion of that skill and industrial intelligence so dear to the heart of the manufacturer, and would prepare the way for an apprenticeship in a well defined trade or lead the way to a trade school if such were a local possibility. The course might with profit be two years in length.

The possibilities of such schools have already been considerably discussed, and in the report of the Committee on the Place of Industries in Public Education, published by the National Educational Association, page 65, will be found a classification of groups of trades that are very suggestive. No doubt basic courses can be found for many allied industries and the cost of the equipment would be within the reach of most communities. A few such schools are already in existence. But we have no assurance that students will enter these schools in appreciable number till they can see some specific inducement. Here again we may study with profit the result of industrial education in the higher institutions. The majority of students who enter the engineering schools stay throughout the four or five years of the course largely because they feel, rightly, or wrongly, that the completion of the course insures them an opening into the industrial field or at least a better one than they could obtain without it. And in this they are not disappointed, notwithstanding the criticism which has been heaped on these schools, some of which is deserved and most of which is not.

If the employer, generally, will rehabilitate the apprenticeship system and make it as effective as the rest of his plant; if he will shoulder again a portion of the load he has endeavored to put upon the schools, where it has no place; if he will take well prepared material from these intermediate schools, I believe a large part of the problem may be solved. But boys and girls will continue to drop out of the public-school system and drift aimlessly into the industries until something specific is offered in the way of preparation, and better provision is made to receive them in the industries. If these schools will do nothing more than give girls and boys an opportunity to discover their natural talents and give them an added interest in the line of work for which they are best fitted, thus carrying still farther the work of the seventh and eighth grades, they will justify their existence.

The Stage of Training in Specific Technical Studies

Actual training in any trade or profession consists in applying the fundamental sciences or skill on which it rests to the specific problems or construction work peculiar to the calling. Thus the teacher of engineering applies the fundamental sciences of mathematics, chemistry and physics to the design and construc-

tion of machinery and the teacher of agriculture in a similar way applies the fundamental sciences which underlie agriculture to the actual production of crops. In the higher grades of education this process is well marked; in the high schools it is not yet so well defined, but as noted before, this will also be more evident with the growth of new forms of high schools. In trade training this aspect of the process of education is clearly defined; skill in the use of the hammer, plane and saw precedes their application to the carpenter, pattern maker or cabinetmaker's trade.

To what extent this part of trade training can be carried out either in connection with the public school or by private schools does not at present seem clear. The costly specialized equipment needed for the many trades seems to make it prohibitive as far as the public schools are concerned except as before stated in the exceptional cases where a few trades dominate the industries of the district. There are many other difficulties in the way as yet, as for instance, the attitude of organized labor, which must justly be considered; the problem of what to do with the product, for product there must be if these schools are to be trade schools; and last, and by far the most important, the question of teachers.

Notwithstanding these difficulties and many others, I believe that as industries develop still farther, we shall find an ever-increasing demand for this part of industrial education, and eventually the trade school will be a prominent feature of our system. At present, however, it would seem that the phase of education covered by the intermediate industrial school is as far as we can go on any large scale.

Practice and Adaptation

The last stage in vocational training, while perhaps having little bearing on *trade* training at present, is worth noting. It is or should be the aim of every course of instruction which prepares specifically for some walk of life to give the student such an amount of actual practice in the art taught as shall bridge over as far as possible the gap which intervenes between the school and the actual field of operation. Thus in the technical schools the last year is usually given over to a large extent to practical or actual engineering problems which call for the application as far as possible of all the preparation which the student has received. All professional schools, such as law, medicine, dentistry, etc., have had to face this problem and all have found it a difficult one to solve. After the school has done its best there still remains something which it cannot give and which must be obtained in the art itself. The coöperative plan comes nearer to meeting this particular phase of education than any other, but as before noted, its field is too limited to class it as a solution of the general problem.

I know that ardent advocates of trade schools claim that it is possible to turn out a finished workman from trade schools, and I am willing to concede that this is possible in certain trades and under special conditions. The prospectus of one of the most successful trade schools that I know of, and one which is a fine example of what can be done, says, "Only those are accepted who are able-bodied, moral, intelligent and possessed of natural aptitude for mechanical pursuits." We cannot apply such selective standards to our public schools, and must not look for any such results as have been obtained by special conditions and picked students. It will be well for us to keep the experience of the technical colleges in mind and not overestimate the value of the product of these lower-grade schools. The employer, on the other hand, recognizing this inherent deficiency should make the proper provision for supplying it, and use as much patience in adapting these recruits as he does in installing a new process, or limbering up a new machine.

A system of schools such as indicated above and which it seems may not be unlikely in the near future in many States is shown diagrammatically in Fig. 2 and may be compared with Fig. 1, which shows schools as they are now ordinarily organized. The relative number of students in each school above the eighth grade is, of course, merely suggestive and the diagram above this grade is for simplicity drawn for 100 per cent. efficiency; that is, the falling off in numbers, which is certain to occur, is omitted for clearness. The efficiency of the first eight grades *should be* as has been noted, 100 per cent. and *all* children should complete these grades.

There is no need of discussing the pupil whose parents can and will send him to the high school, except that it is a pity that monetary considerations are such a marked factor in deciding who may and who may not continue their education. There are enough graduates from high school and college, as far as the simple demands of industry are concerned, but there is never enough of the *right* kind. The problem of selection is, however, a difficult one and the way to educate the proper kind and *only* the proper kind for the several levels of life does not seem very clear. With our present ideals it may never be clearer.

If the boy's parents cannot see their way to send him to the high school they may see a way to send him to the intermediate industrial school, especially if there is a better opportunity for him at the end of the course; *and if the work be of the character as will appeal to him, the boy will gladly go.* The report of the Commission on Industrial and Technical Education in the State of Massachusetts shows that out of 2623 families, 2004 or 76 per cent. were financially able to give their children "industrial training if persuaded of the advantage." What better argument can be offered for this type of school if it can only receive the support of employers and factory managers?

The number of children who could be persuaded to go, or whose parents could afford to send them still farther to one-year or two-year trade schools, or the probable success of four-year trade schools leading directly from the eighth grade, is problematic in the present state of our industries. The success of such schools must be largely a matter of the *volume* of a given business in the section considered. No doubt, however, in time, all these forms of schools will become permanent factors in our system.

It will be necessary, probably, at first to organize these intermediate industrial and trade schools apart from the public-school system as it now exists in order that they may not be overshadowed by the older and stronger curriculum and in order to study the problem properly. A separation may be necessary in order to repress the tendency, common to all schools, to grow into institutions of a higher order. Such a tendency would be absolutely fatal to schools of this character. In large and populous centers such a differentiation may be advisable and economical always; but, in general, much money may be saved and better results obtained by keeping all courses in secondary education grouped together in one building or group of buildings. One of the greatest dangers, and a frequent error in vocational training is premature specialization. Some of the higher institutions have already learned their lesson regarding this danger, which is the one which fills the older students of education with justifiable alarm, and have in some instances retraced their steps. One or all of the various courses outlined in Fig. 2 between the eighth and twelfth grades might in many places be housed in one building or group of buildings and in time we shall no doubt see secondary education organized very much as our universities now are, where many courses in many subjects will be taught, these being vocational or nonvocational according to the likes of and intentions of the pupil. There is a tremendous educational value in having the student see other lines of work outside of his own. The central idea of such schools should and will be that *all* students entering them will, no matter whether they stay one or four years, go out of them with some training which will make them more efficient in their life work and with quickened ideals of citizenship.

For it is not enough that all shall be educated to be efficient producers. What we need, as a people, is more light on the correct methods of controlling and

distributing the results of productive industry. *Trade training* in a literal sense in any grade, primary or university, will not suffice; and all such training to be effective must rest on a liberal foundation. The general or liberal studies should be carried as far up as possible in all courses so that the trade and industrial schools, the technical and agricultural high schools and the professional colleges are simply outlets at various stages from the general stream of education to the field of life. Thus the boy who expects to go to a technical university should be prepared in a *standard* high school and *not* in a technical high school, for the higher up he is to be carried the deeper should be his grasp of the principles which lie at the bottom of good government and good citizenship.

Nor must it be assumed that industrial or trade training of any kind will make all men and women efficient and successful. Industrial training can only provide *tools*, but as Dean Davenport, of the University of Illinois, has said, "success in any calling is the price of unremitting and exhausting toil, against which education is no insurance. It can only promise that faithful labor shall have its adequate and sure reward. And that is enough, for no man has a right to ask to be freed from labor on earth; he can only pray to be relieved from the burden of aimless and fruitless drudgery—which is the blessed assurance of education."

The New Britain Trade School

BY ENTROPY

The State of Connecticut, following the example of other Eastern States, has entered upon an experiment in industrial education. The State Board of Education has established two schools, one at Bridgeport and one at New Britain. These are strictly State schools, not having any local board of control. They are supported wholly by the State, though I understand that favors from local sources are acceptable.

These schools represent a phase of public industrial education that is bound to be repeated in other communities and that may well be given serious thought.

Both schools are not only under a board formerly entrusted with public-school work, but were started under and by public-school teachers. Events proved very early that this was unwise. The schools as first conducted were manual-training schools with a larger proportion of shop work to be sure, but manual-training schools in aim and methods. A rather rapid change of instructors has followed the discovery of this fact by the board of education, so that now these two schools bid fair to follow closely in the line of those schools that make a commercial shop a most important part of their makeup. That this evolution has taken place within the short term of a year speaks volumes for the strength of the arguments for commercial shop methods of instruction and also speaks well for those of the men who have stuck to the task through the process of evolution and have evolved with it.

When one considers the depth to which the roots of traditions strike in the public schools, one must grant that it must have taken a severe wrench to tear away from them. The public-school system for a century past has built on the basis of the equality of all human beings, thus attempting to carry out the terms of the Constitution, even though the rest of us consider that portion as a variety of humor. The newer education, of which the Connecticut schools are becoming exponents, recognize that while we may all be free we are not equal and that education if carried beyond the three R's must be different for the lawyer and the blacksmith, the priest and the soldier. The present danger appears to be that the pendulum may swing too far and that it may be forgotten that there is need of well balanced men who know something of other things that the making of money, and that there is a duty of the State, when it takes upon itself the education of the young, toward giving each of our future citizens a reasonable amount of that culture that gives him information about himself, his relation to society, to government and toward the laws of nature.

It must be remembered that while a man's first need is to coin his daily bread, his better nature demands butter as well, and that if we educate simply to put a man above the bread line, we are only doing part of our duty. There is the necessity that each man should intelligently take the part which the country imposes on him as a citizen. It is easy to so specialize education that the graduate will be only a living mechanism with no soul beyond a train of gears.

A FACTORY BUILDING HOUSES THE SCHOOL

The New Britain school is fortunate in having available a very suitable building. The Corbin Brothers Company had an unused factory about 100 feet square with a saw-tooth roof, located about a mile from the center of the town. This, with a power plant in a separate building and an electric transmission, was available and ready to use.

THE SHOP EQUIPMENT

The machine-shop equipment, in which the readers of the AMERICAN MACHINIST are most interested, is well selected. It consists of a dozen engine lathes ranging from 12- to 18-inch swing and all of different makes or sizes, a shaper, two planers, one a new 24-inch by 6-foot; the other an older and smaller machine; an upright drill about 24-inch, a vertical miller and a No. 1½ universal miller, together with a rather limited line of small tools, to which I understand it is their intention to add by making.

Instruction in the shop is now being carried on by men from the local shops, and by the simple method of the shops of going from one boy to another, each one being on a separate job. This method appears to have one drawback, which they overcome in a way which seems to leave a balance on the right side of the ledger. The drawback is that it takes so long to get around from one boy to another that he does not always have work to keep him out of mischief. The offset consists in having the unoccupied boys follow around with the instructor, hearing his talk to the other boys and getting the benefit of any mistakes that these other boys may make.

In addition to shop work the boys are given the drawing, mathematics and English that especially relate to the trade. This work is done in a very individual way as must needs be the case when boys are admitted at any time and regardless of their previous school record. While this is an ideal method from one point of view it is very expensive and sacrifies the time of the more advanced boy, inasmuch as the instructor must give most of his time to the backward boy.

On the other hand, if industrial education is worth anything it is worth working for. If a boy knows that he cannot enter a trade school until he has passed through a certain number of grades of the grammar schools, he will pass through those grades, for it is certain that the failure of pupils to pass elementary grades is due to inattention and lack of interest rather than lack of ability to do the work.

Gasolene Electric Bus for London

Novelty in the shape of a new type of motor bus is said to be under contemplation for the streets of London. These vehicles are of the combined gasolene-electric variety, but are entirely new in many respects. Two independent 12-horsepower, four-cylinder gasolene motors each drive, though an electric "dynamotor" and a flexible shaft, one of the rear wheels of the vehicle. When the load is light, the excess power of the engines is absorbed by the dynamotors as dynamos to charge a special 560-pound storage battery. When the load is heavy, the dynamotors automatically are changed into electric motors and assist the engines, taking power from the batteries. By this arrangement, not only are starting and control much smoother and quieter, but by the more constant load upon the engines, the fuel economy is improved. The vehicles are of steel construction, including the wheels.

Dynamometer Test for Auto Chassis

By C. B. Edwards

Finding the defects of the practically complete automobile by driving a fan dynamometer from sprockets on the rear axle.

Opportunity to closely observe action of all parts while operating under load.

One very interesting feature in automobile testing introduced at the factory of the Inter-State Automobile Company at Muncie, Ind., is the fan dynamometer test, for motors, transmissions and rear axles, known to the employees of the factory as the "monkey test."

In the endeavor to discover the origin of the troubles to which the new-born automobile is heir, the manufacturers of the Inter-State adopted this test. It has always been more or less difficult to find and remedy these ailments in the course of the block and road tests. In the former the motor alone is tested and then while running light. In road testing the driver cannot detect with great accuracy the different symptoms for the simple reason that his faculties are more or less occupied in handling the car and are dulled by the confusing noises incident to running over rough and uneven roads.

The Apparatus

The apparatus as finally adopted is most satisfactory in the results derived and in its simplicity. The accompanying halftone shows the principal parts and arrangement of the device. It consists essentially of a horizontal shaft, mounted in substantial bearings and carrying four fan blades whose surfaces are held at right angles to their path of rotation. These blades are mounted upon radial supporting arms in a manner which permits of their adjustment to vary the diameter of their circle of travel. This allows the load to be increased or diminished, as it is evident that as the circle described by the fan blades is made larger, more power will be required to drive them. It follows also that the faster they are driven, the greater will be the power absorbed and thus the load upon the motor is varied exactly as under actual running conditions.

The apparatus is driven by means of sprockets on the shaft, which are in turn driven by chains from sprockets mounted just as are the wheels upon the rear axle of the car. By this arrangement every part of the driving mechanism is subjected to such strains as are received under road conditions and any weakness is thus disclosed.

Making Tests

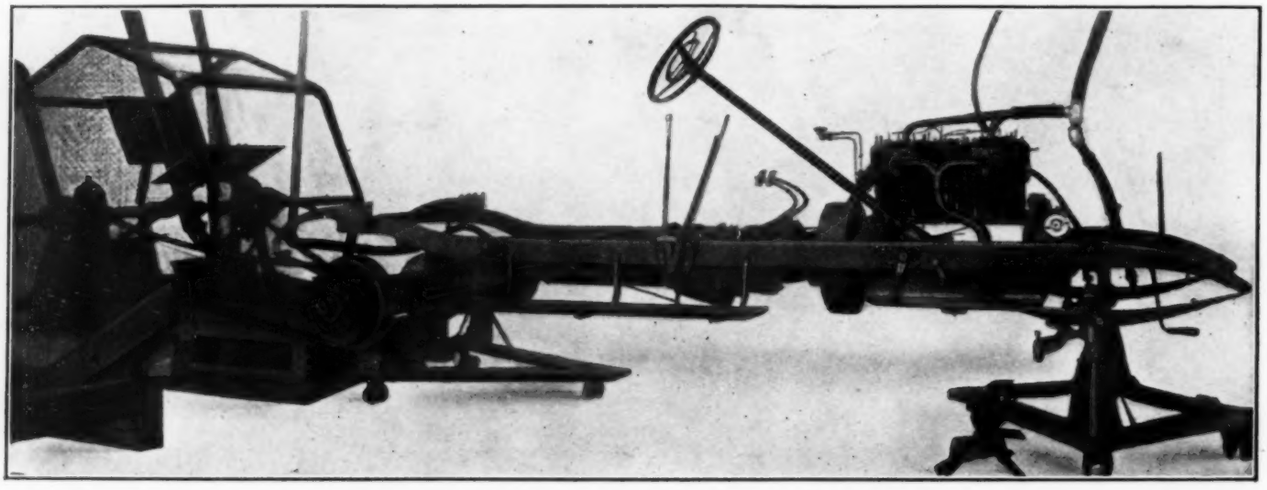
A speedometer is fitted to the shaft of the dynamometer and the speed of the car and the distance traveled were it running upon the road, recorded. The actual running time and the elapsed time are also noted. In this manner a positive test is assured and under conditions which insure the detection of any fault in construction.

The running time varies from six to eight hours at speeds ranging from twenty to sixty miles per hour, the length of time depending largely upon whether or not defects are discovered in the different parts. This is equivalent to a run of from 200 to 250 miles on the road. This test is really more severe than the road test, for it imposes a constant load upon the motor, or has the same effect as running up a continual grade. The momentum of the fans is not sufficient to carry the motor through its revolutions as the car does in descending a grade, so the "rests" of actual road use are entirely absent.

Finding Defects

The operator in attendance works the car through the different gear changes and speeds. Any noise which may be discovered in the transmission while running on intermediate or low speeds is immediately remedied. The differential gears may be inspected and trouble arising from faulty construction or improper adjustment eliminated. Any defect or knock in the motor may be located without a possibility of doubt as to its exact nature, for the operator can give his undivided attention to these details. The action of the clutch is noted and all adjustments made which will facilitate its perfect operation. The brake-operating levers and rods may also be adjusted while the chassis is on test.

Many cars which have developed no weakness upon the road test have been found defective by this method. It is evident that it is as fatiguing as that which the most difficult roads can impose, and should guarantee perfect operation under the latter conditions.



Testing Automobile Chassis with Fan Dynamometer

What is reported to be the largest locomotive in the world has just been turned out of the Santa Fe shops at Topeka, Kansas. It is 122 feet long, has ten pairs of driving wheels in two sets of five pairs. It is nearly twice as large as the largest locomotive shown at the St. Louis World's Fair in 1904. The new Santa Fe locomotive is the Mallet or double type and costs $50,000.

Milling Cutters, Their Efficiency—II*

By A. L. DeLeeuw†

An account of a systematic series of experiments with cutters of greatly increased pitch which have given such favorable results as to lead to their adoption by the Cincinnati Milling Machine Company.

An account is also included of experiments with helical cutters of greatly increased helix angle.

*A paper to be presented at the spring meeting of the American Society of Mechanical Engineers.

†Mechanical engineer, the Cincinnati Milling Machine Company.

Side-slotting and Face Mills

Fig. 14*a* and 14*b* show the side mills and Fig. 15 gives a comparison of the new- and old-style side mills and slotting mills.

Face mills have also undergone a gradual evolution and they are now used by the company and cataloged, though not made by them for use of customers, as shown in Fig. 16. Fig. 17 shows a cutter of a design now generally considered to be standard. In this latter design, the blades are spaced 1 inch apart, or approximately so; they are set radial, and have no means to keep them from pushing back except the regular holding means. The wide-spaced face mill, on the other hand, has blades spaced 2 inches apart. They are set at an angle of 15 degrees with the radial line, and are backed by a backing ring with a set screw for each blade. These set screws allow the blade to be adjusted, besides forming a stop against upward movement under pressure. A face mill may be considered as a planing tool moving in a circular path. The cutting edge, therefore, is axial and not radial. To set the blades at an angle with the axis does not produce rake, because the blades are set at an angle with the radial line.

It will be noticed that the blades are set at an angle with the axis. It will further be noticed, in the enlarged view of the blades, showing the rounded corners, that the corners are not provided with a round, but rather with three faces, which together approximate a curve. It is to offset the effect of this round that the angle with the axis is introduced. In Fig. 18 a new-type face mill is shown at the left and at the right a mill of the old or regular type.

However accurately a milling machine may be built, the spindle is not exactly at right angles with the table. The amount of variation from the right angle is very small in a properly built machine, but some variation exists. Besides, this variation is liable to become greater when the machine wears. The result is, that when feeding in one direction the leading teeth of the cutter dig deeper into the work, leaving the other side of the cutter entirely clear, but when feeding in the opposite direction the opposite takes place, which makes the teeth drag over the work. In order to provide the teeth with clearance, the back end of the tooth is ground away at an angle of three to five degrees.

It will further be noticed, that there is a land of 3/16 inch only where the blade is straight. It is the excess of width of the cutting blades which is liable to cause chatter. Strange as it may seem, this chatter is more pronounced with a light than with a heavy cut. It is not meant that there is actually chatter, but merely that when there is a tendency to chatter, the tendency is greater on a lighter cut. The cause is that the tooth does not enter the work but tries to ride over it. When the cutter has been lifted sufficiently, the pressure becomes great enough to make the blades enter. The next blade meets the same difficulty about entering, is lifted again, and so on. This action causes a series of radial chatter marks and is very much worse with wide blades than with narrow ones; and again very much worse with a large number of blades than with a few. A 3/16-inch land proved to be an acceptable compromise, as a wider land would quickly dull the cutter, even if it did not make a chatter mark, while a narrower land would have a tendency to produce a scratchy finish.

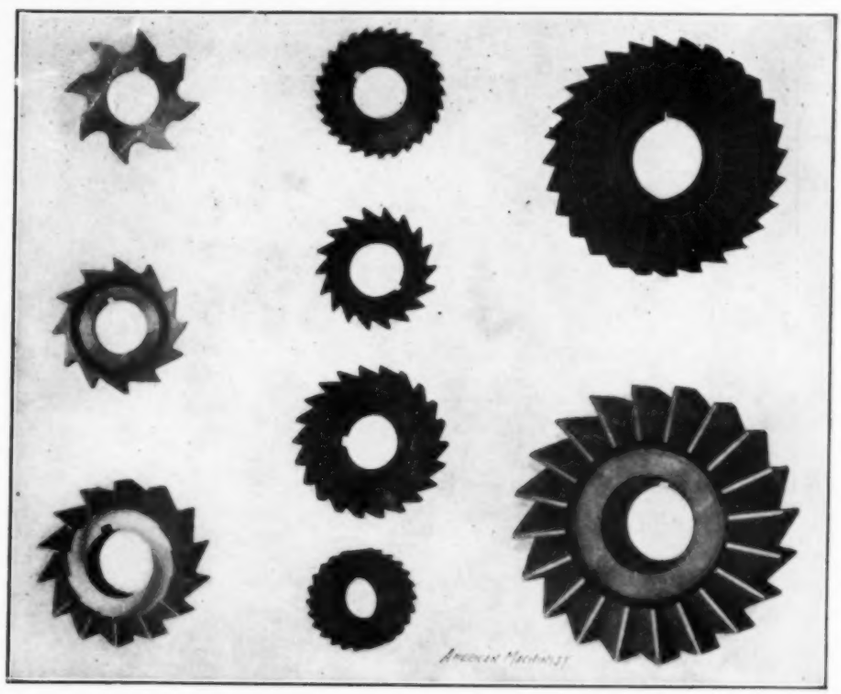


Fig. 15. Comparison of Side and Slotting Mills

The Helical Cutter

In Fig. 19 are shown details of a helical cutter. These cutters consist of a cylindrical body, with two or three screw heads wound around them, the threads being of a section clearly indicated in the engraving. The helix is wound around the body with an angle of 69 degrees with the axis. The diameter is 3½ inches and the lead of the helix 4¼ inches. They are made in two styles, either single, or as interlocking right- and left-hand cutters. They are made with a rake of 15 degrees and clearance of 5 degrees when used for steel, and with a rake of 8 degrees and clearance of 7 degrees when used for cast iron. Their most distinguishing feature is, that they push the chip off in the direction of the axis of the cutter, or at right angles to the feed. The power consumption is extremely low for steel, but does not show up so favorably for cast iron. A roughing cut in steel requires only about one-third the power of an old-style spiral mill. Another distinguishing feature is, that this cutter does not make revolution marks but tooth marks. As a result, a much

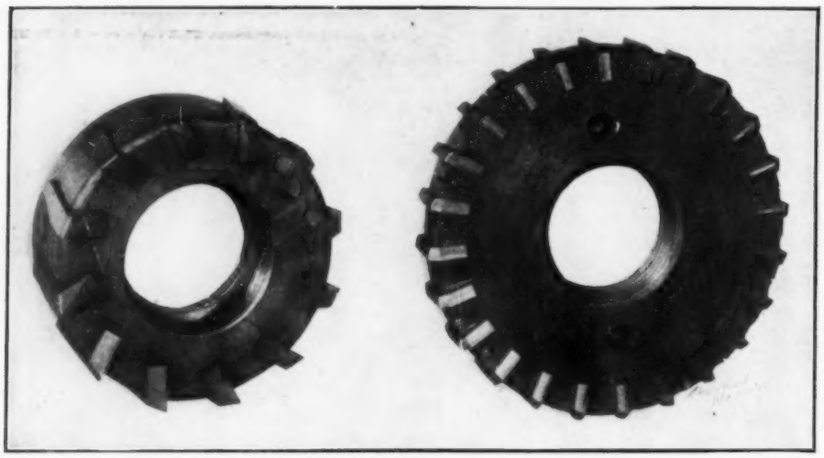


FIG. 16. COMPARISON OF HIGH-POWER AND FACE MILLS

coarser feed can be used for finishing. A cutter with three teeth will allow of a finish three times as fast as an ordinary spiral mill. Still another feature of this cutter is the entire absence of spring in the arbor when cutting steel. It is possible to take a finishing cut over a piece of steel, then return the work under the cutter and let the cutter revolve any length of time without producing a mark. Fig. 20 shows how this feature was made use of in the milling of steel test pieces.

It was originally thought that a single cutter of this description would do well for finishing, but not for roughing, on account of the excessive end pressure on the spindle, and the interlocking cutter was made to obviate this end pressure. However, it was found that this end pressure, though perceptible, was no disturbing element. Cuts which required 80 amperes with the interlocking cutter, required 85 amperes with the single cutter. In order to see if continued use of the single cutter would cause increasing friction at the spindle end, a great number of cuts were taken in as rapid succession as it was possible to adjust the machine for the next cut.

The fact that there is no spring in the arbor makes it possible to use the milling machine without braces in a great many cases where they would otherwise be needed.

The chips come from the work in the form of gimlets, as shown in Fig. 20. The back of the chip is polished or burnished, and a surface of the work shows no sign of tearing of the metal.

It was first believed that these cutters would work best at a high speed; but it was found that this was not the case. They produce the best results when run at the same number of revolutions as the ordinary spiral mill.

"VIRTUAL RAKE"

The writer believes that the remarkably low power consumption is due to what might be called "virtual rake," which is an angle depending on the angle of rake, and on the angle the thread or tooth makes with the axis. This virtual rake becomes a small angle when the actual

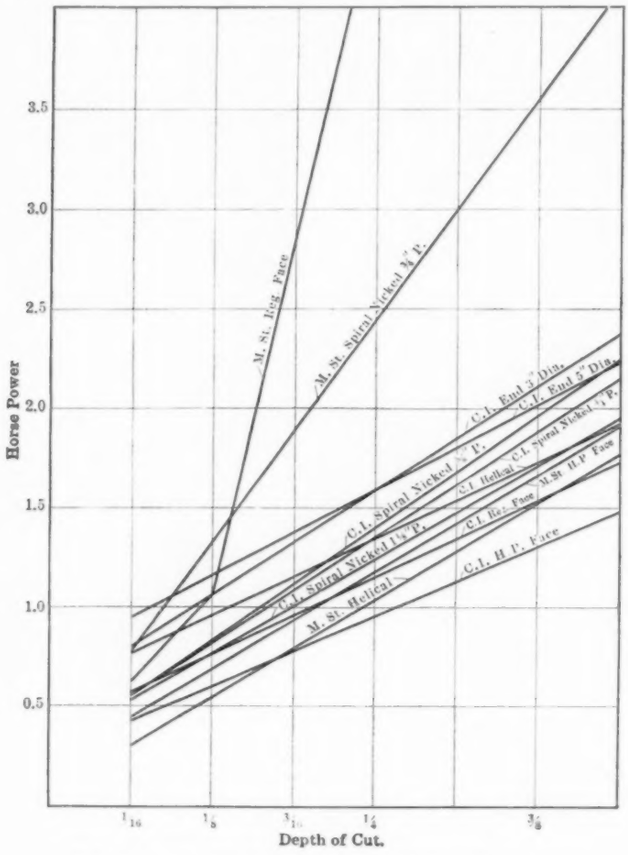


FIG. 21. EFFICIENCY TESTS OF CUTTERS. COMPARISON CURVES REDUCED TO 1 INCH WIDTH OF CUT. CAST-IRON CURVES CORRECTED FOR HARDNESS OF MATERIAL. FEED, 4 INCHES PER MINUTE

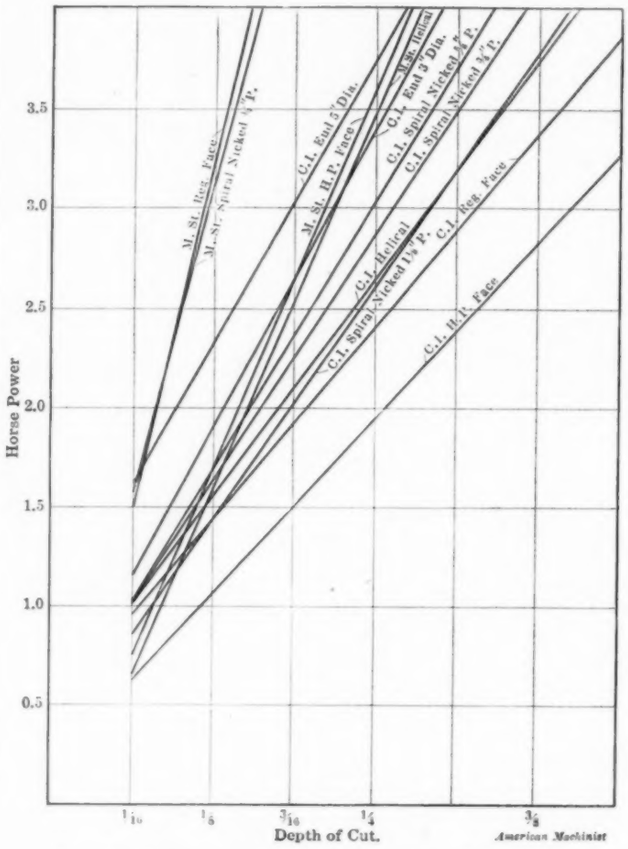


FIG. 22. EFFICIENCY TESTS OF CUTTERS. COMPARISON CURVES REDUCED TO 1 INCH WIDTH OF CUT. CAST-IRON CURVES CORRECTED FOR HARDNESS OF MATERIAL. FEED, 14 INCHES PER MINUTE

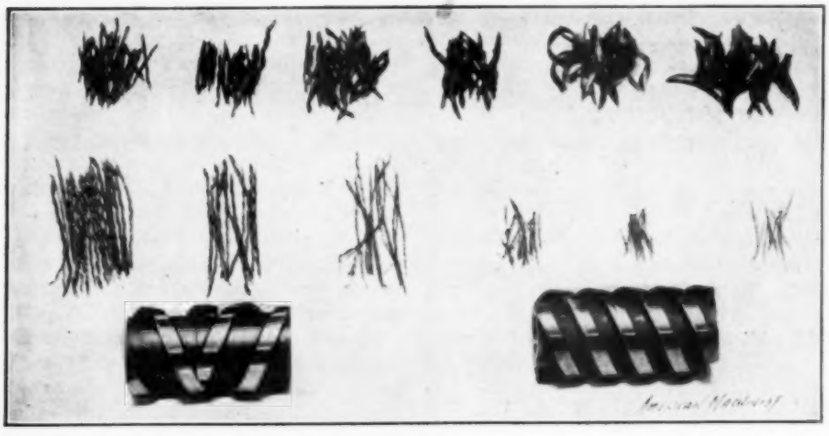


FIG. 20. HELICAL CUTTERS SINGLE AND INTERLOCKED AND CHIPS PRODUCED BY THEM

rake is small. This is the case with the cutter as used for steel, where the actual rake is 75 degrees. Where, however, the angle of rake approaches 90 degrees., the influence of the helix becomes very much less pronounced; and, if the actual rake were 90 degrees, the influence of the spirality would be zero; in other words, the virtual would equal the actual rake. This may explain why the saving in power consumption is not so pronounced when cutting cast iron. It is believed that this saving of power would be equally great with cast iron as with steel, if the same virtual rake could be obtained, and this supposition was borne out by a few tests made on cast iron with a helical cutter ground for steel. The fact, however, that the edge of the cutter would not stand up, made it impossible to extend the tests far enough to come to a safe conclusion.

Another reason which suggests itself to the writer, as to why the helical cutter shows less saving in power on cast iron than on steel, is the result of a series of tests made on cast iron and steel with spiral mills with and without rake, the rake being in all cases 9 degrees. These cutters showed improved efficiency for steel and cast iron, but much more for the first than for the latter. A cutting

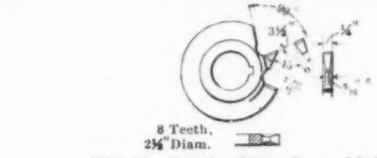


FIG. 14a. Details of New Type of Side Mills.

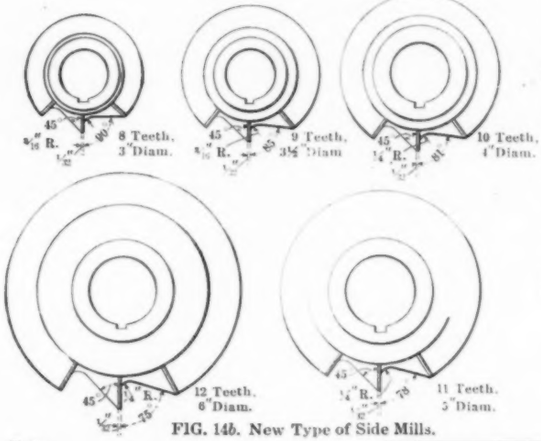


FIG. 14b. New Type of Side Mills.

No. of Mach.	A	B	C	E	D and Thread
2	2 9/16	1 11/64	½	¾	2¼" - ¼ P - 5 Thds. 1" Lead. U.S.S. Shape
3	3 1/16	2 27/64	½	¾	3¼" - ½ P - 5 Thds. 1.06" Lead. U.S.S. Shape
4	4 1/16	3 5/16	⅝	⅛	4" - ¼ P - 5 Thds. 2" Lead. U.S.S. Shape
5	4 13/16	3 13/16	⅝	⅛	4¼" - ¼ P - 5 Thds. 2" Lead. U.S.S. Shape

Note: When ordered with Blank Hole, make Hole 2⅛" suitable for No. 2 Mach.

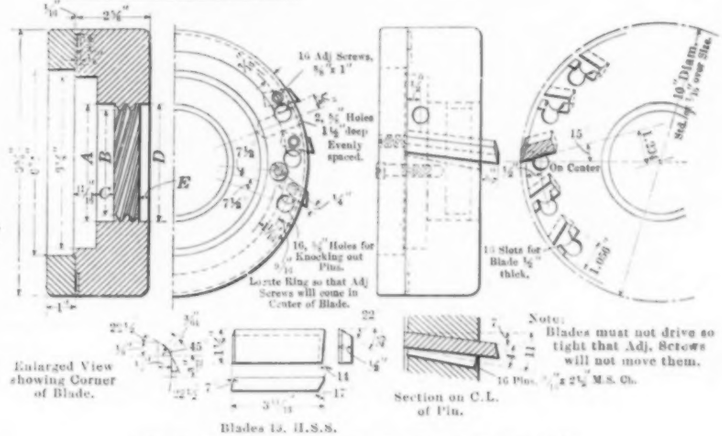

16 Adj. Screws, ⅝ x 1"
2, ⅝" Holes 1¼" deep Evenly spaced.
16, ⅝" Holes for Knocking out Pins.
Locate Ring so that Adj. Screws will come in Center of Blade.
On Center
15 Slots for Blade ⅛" thick.
Std. 10" Diam. ½" over Size.
Enlarged View showing Corner of Blade.
Section on C.L. of Pin.
Blades 15. H.S.S.
Note: Blades must not drive so tight that Adj. Screws will not move them.

FIG. 16. Ten-Inch Blade Face Mill for High-Power Machines.

Note: All Blank Cutters to be Bored ⅛" smaller than Bottom of Thread of smallest Spindle Nose used i.e.-2⅛" Bore.

Cone Type Millers.					
No. of Mach.	A	B	C	E	D and Thread
3	2 9/16	⅜	⅛	2⅛	2⅛" - 6 Thd. U.S.S.
4	3 1/16	⅛	⅛	3 5/16	3⅛" - 4 Thd. U.S.S.

High Power Millers.					
No. of Mach.	A	B	C	E	D and Thread
2	2 9/16	⅛	⅛	2⅛	2⅛" - ¼ P - U.S.S. 5 Thd. to 1¼" Lead.
3	3 1/16	⅛	⅛	2⅛	3⅛" - ½ P - U.S.S. 5 Thd. to 1.006" Lead.
4	4 1/16	⅛	⅛	3 5/16	4" - ¼ P - U.S.S. 5 Thd. to 2" Lead.
5	4 13/16	⅛	⅛	3 13/16	4¼" - ¼ P - U.S.S. 5 Thd. to 2" Lead.

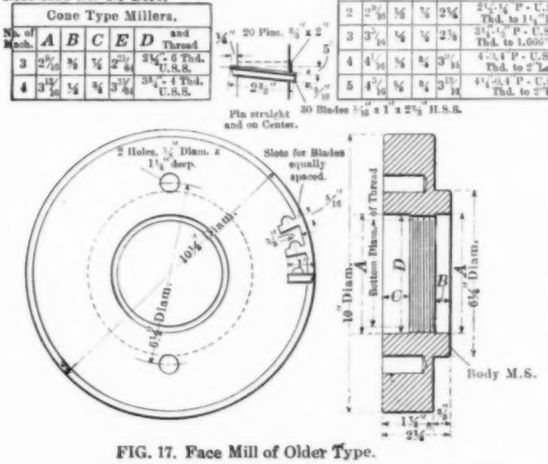


FIG. 17. Face Mill of Older Type.

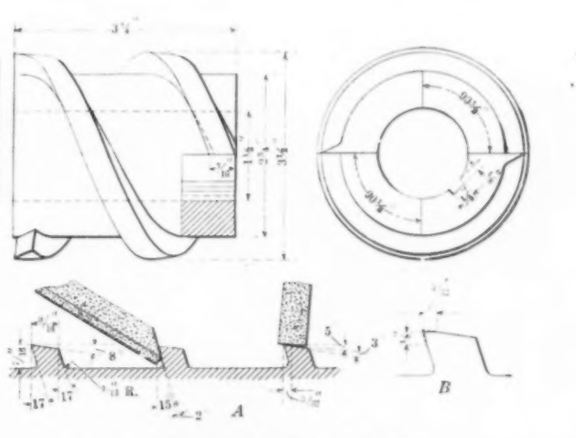


FIG. 19. Details of New Type of Helical Cutter.

American Machinist

SEVERAL TYPES OF MILLS AND A NEW TYPE OF HELICAL CUTTER

tool must detach the chip from the work, bend the chip and at least partially break it up. When cutting steel, the radius of curvature of the chip becomes greater with increased rake and the extent to which the chip is broken up becomes less. Cast iron will stand much less bending before breaking, so that, even with increased rake, the chip is still broken up as before, and no saving in power can be effected in this part of the process.

Figs. 21 and 22 are diagrams comparing the performance of different styles of cutters for different materials and the different depths of cut. Fig. 21 gives a comparison with feeds of 4 inches per minute and Fig. 22 for 14 inches per minute. It will be noticed that all lines are practically straight with the exception of the line for the regular face mill when cutting machinery steel. This line makes a sharp turn. This is believed to be due to the fact that the blades of this face mill did not project far enough beyond the body. As cast-iron chips were crumbled up the effect was not noticeable for cast iron, but became quite important for machine steel. Fig. 21 shows that for cutting cast iron the high-power face mill is the most efficient. Then comes the regular face mill, then the spiral mill with 1⅛-inch spacing, then the spiral mill with ¾-inch, then the spiral mill with ⅝-inch spacing. The 5-inch and 3-inch end mills come last in efficiency. These mills are of the old type with relatively fine spacing.

The order of efficiency of the different cutters is somewhat different for machine steel. The helical mill comes first, then the high-power face mill, then the spiral mill with ¾-inch spacing (no tests were made with the spiral mills with ⅝-inch and 1⅛-inch spacing on machine steel) and finally the regular face mill; but it should be noticed that, if the curve for this mill had continued the way it started, it would have been below the curve for a spiral mill.

Fig. 22 gives comparative curves for a feed of 14 inches per minute. The order of efficiency is much the same as in Fig. 21 with some exceptions. The helical mill, for instance, becomes more and more efficient as the heavier cuts are taken.

Congress of Technology

A careful study of the papers presented at the Congress of Technology, held in Boston on April 10 and 11, gives something of an idea of the many fields of industry into which the graduates of the Massachusetts Institute of Technology have made their way. Every paper was by some graduate of this institution, the whole being divided into six sections, according to the industry which they represented, as far as possible.

These general classifications were: Scientific Investigation and Control of Industrial Processes; Technological Education in its Relation to Industrial Development; Administration and Management; Recent Industrial Developments; Public Health and Sanitation and Architecture.

Under these various headings many phases of important problems were carefully presented from all the leading industries of the United States and from men who are well known in their respective fields. The organizers of this congress are to be congratulated on the wealth of material secured.

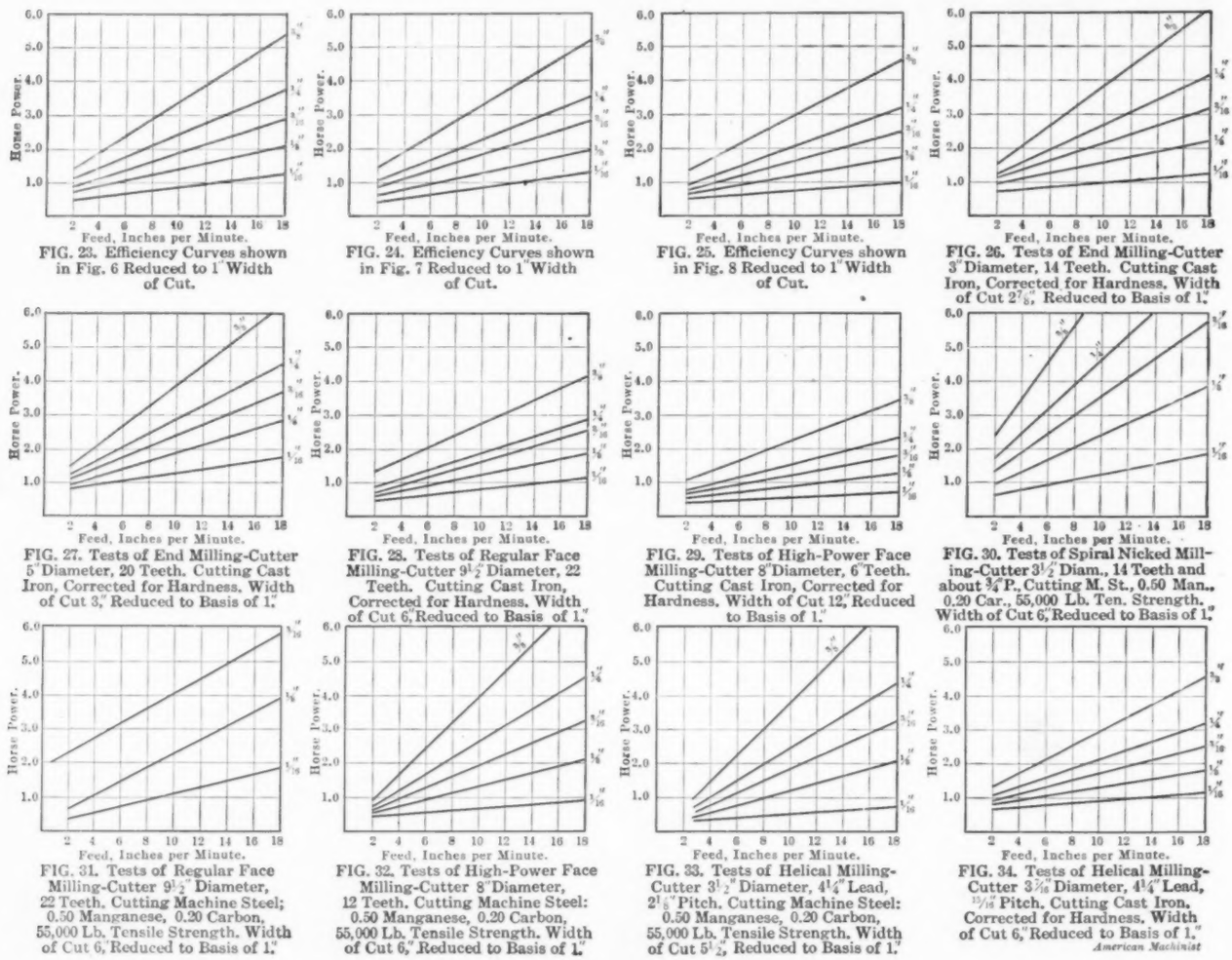


FIG. 23. Efficiency Curves shown in Fig. 6 Reduced to 1" Width of Cut.

FIG. 24. Efficiency Curves shown in Fig. 7 Reduced to 1" Width of Cut.

FIG. 25. Efficiency Curves shown in Fig. 8 Reduced to 1" Width of Cut.

FIG. 26. Tests of End Milling-Cutter 3" Diameter, 14 Teeth. Cutting Cast Iron, Corrected for Hardness. Width of Cut 2⅞", Reduced to Basis of 1."

FIG. 27. Tests of End Milling-Cutter 5" Diameter, 20 Teeth. Cutting Cast Iron, Corrected for Hardness. Width of Cut 3," Reduced to Basis of 1."

FIG. 28. Tests of Regular Face Milling-Cutter 9½" Diameter, 22 Teeth. Cutting Cast Iron, Corrected for Hardness. Width of Cut 6," Reduced to Basis of 1."

FIG. 29. Tests of High-Power Face Milling-Cutter 8" Diameter, 6 Teeth. Cutting Cast Iron, Corrected for Hardness. Width of Cut 12," Reduced to Basis of 1."

FIG. 30. Tests of Spiral Nicked Milling-Cutter 3½" Diam., 14 Teeth and about ¾" P., Cutting M. St., 0.50 Man., 0.20 Car., 55,000 Lb. Ten. Strength. Width of Cut 6," Reduced to Basis of 1."

FIG. 31. Tests of Regular Face Milling-Cutter 9½" Diameter, 22 Teeth. Cutting Machine Steel; 0.50 Manganese, 0.20 Carbon, 55,000 Lb. Tensile Strength. Width of Cut 6," Reduced to Basis of 1."

FIG. 32. Tests of High-Power Face Milling-Cutter 8" Diameter, 12 Teeth. Cutting Machine Steel: 0.50 Manganese, 0.20 Carbon, 55,000 Lb. Tensile Strength. Width of Cut 6," Reduced to Basis of 1."

FIG. 33. Tests of Helical Milling-Cutter 3½" Diameter, 4¼" Lead, 2⅛" Pitch. Cutting Machine Steel: 0.50 Manganese, 0.20 Carbon, 55,000 Lb. Tensile Strength. Width of Cut 5½, Reduced to Basis of 1."

FIG. 34. Tests of Helical Milling-Cutter 3⅛" Diameter, 4¼" Lead, 15/16" Pitch. Cutting Cast Iron, Corrected for Hardness. Width of Cut 6," Reduced to Basis of 1." *American Machinist*

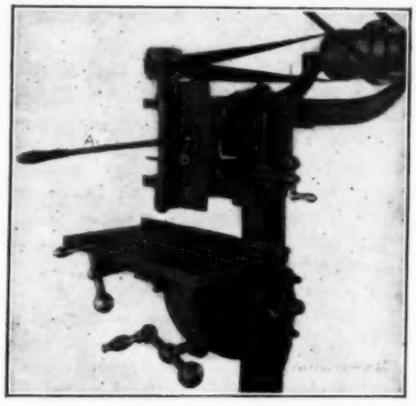
EFFICIENCY CURVES AND TESTS OF VARIOUS TYPES OF CUTTERS

Letters from Practical Men

Concerning the details of making things in machine shops, from the first sketch to the shipping room. A letter good enough to print will be paid for. The value is in the idea—not the length of the letter

An Old Die Sinking Machine

The old die-sinking machine shown in the halftone is "still doing work at the old stand" in the shops of the Lamb Knitting Machine Company, Chicopee Falls, Mass. The notable feature about the machine is the vertical feed which is by means of the long lever *A*. In the center of the lever a ball *B* is formed which works in the spherical socket in the vertical slide *C*. At the back end the lever



AN OLD DIE-SINKING MACHINE

is fitted to a horizontal pin in a yoke *D* which is free to turn on a vertical axis. The combination of ball and socket and yoke not only allows, the vertical movement of the slide *C* but also permits the horizontal movement of the saddle *E*, carrying the vertical slide on the cross rail, by means of the screw *F*. This machine was built by the Aimes Machine Company, 40 or 50 years ago and while it is somewhat light, as machines of that period were apt to be, it is still capable of doing a good job and gives testimony of work well done.

Sawing the Slots in Knitting Machine Cones

At *A* is a cone blank and at *B* one with the needle slots sawed in it on the special machine shown in the halftone.

The machine is built on lines very similar to a shaper except that there is no feed to the tool and no clapper block to relieve the cut on the back stroke. The cutter used is a special saw *D* of the proper thickness which is secured in the bar *C* split on the under side to receive it. The blank is secured inside the fixture *I* which is elevated by an eccentric mounted on the same shaft as the ratchet wheel *H*. The feed takes place before the saw enters the work and is obtained from the dogs *K* on the ram which reciprocate the bar *F* carrying the pawl *G* by means of the lever *E*. When the cut is complete the eccentric feed shaft is turned by hand using the crank handle *J*. Spacing is done by hand in the usual way and needs no explanation. This machine was built by the Lamb Knitting Machine Company, Chicopee Falls, Mass., and is in use in their shops.

New York. E. A. DIXIE.

Mechanical Engineer Wanted?

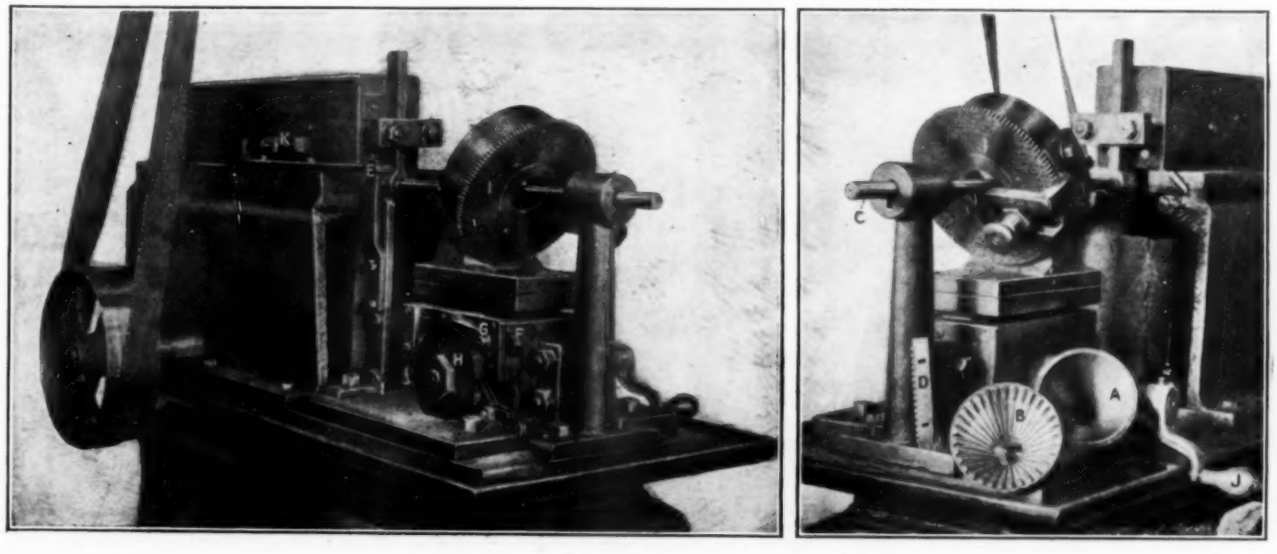
In a recent issue of a well known technical journal, there appeared the following advertisement:

"Well established iron works, owning modern plant and manufacturing a staple line, protected by patents, desirous of extending business, wants from $40,000 to $50,000 additional capital. A splendid opportunity for a mechanical engineer or for any one desirous of serving as secretary or treasurer."

What I want to know is, where on earth is there a plain mechanical engineer with $40,000 in his jeans? Is this a joke or do some mechanical engineers secure rich wives? Surely current prices for "graduate engineers" do not lead to any other method of salting down the coin.

Even assuming that he had the money, $40,000 seems like a big price to pay for a job. Sounds something like the premium apprentice system in vogue in European countries.

New York. R. S. BAYARD.

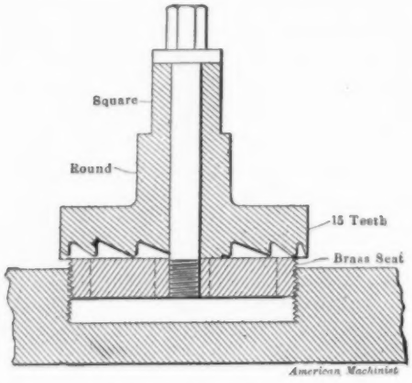


SAWING THE SLOTS IN KNITTING-MACHINE CONES

Facing Valve Seats on Water Pumps

The screwed-in brass-valve seats for steam-water pumps soon wear and, in most cases, are removed, faced off and replaced, which is anything but a simple operation, so the tool shown in the accompanying cut was made for facing the valve seats without removing.

The facing tool itself is made from a



TOOL FOR FACING VALVE SEATS ON WATER PUMPS

piece of tool steel ⅛ inch larger in diameter than the valve seat and has teeth milled on the bottom to do the cutting. It is held in place, as shown, by a ½-inch bolt which also acts as a feed, and a few turns of the tool with a wrench makes a first-class surface on the valve seat.

Clinton, Ia. CHARLES MARKEL.

A Horizontal Drilling Fixture

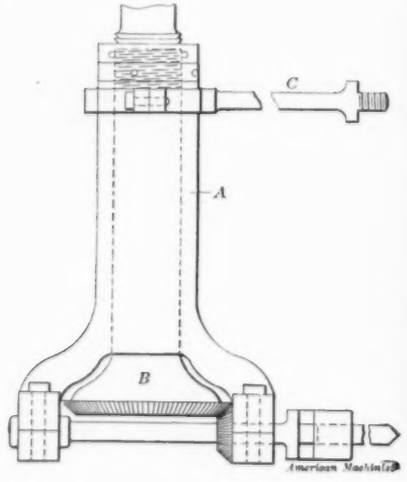
Having a lot of gunmetal boxes with bosses inside to drill, which could not be drilled from the outside, I made the device shown in the cut.

The body *A* was cast of gunmetal and the part *B* was so made that the gear ring from a three-inch Cushman universal chuck could be fitted to it. The small pinion on the horizontal drilling shaft was also taken from the same chuck.

The part *C* was screwed into the column of the drill press to keep the body of the device from turning, but the locking collar and screws made it easy to shift the body to whatever angle was needed.

This fixture was not only used for drilling but it came in very handy for horizontal milling and rack cutting.

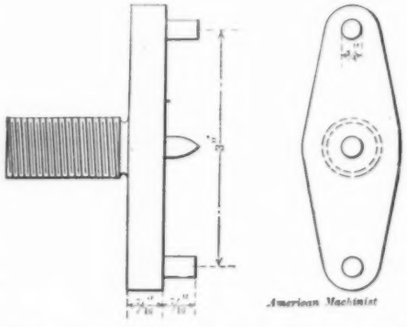
Manchester, Eng. X. BIRMINGHAM.



A HORIZONTAL DRILLING FIXTURE

A Drive Center for the Wood Lathe

The accompanying cut shows a drive center for a patternmakers' wood lathe which we have found to be very handy for turning split or solid patterns. We use end plates made of vulcanized fiber,



A DRIVE CENTER FOR THE WOOD LATHE

with holes in them to receive the ¼-inch pins of the drive center. These plates are very durable and are easily kept cool on the tailstock end by lubricating with white lead.

Our former practice was to screw an iron plate, having a projecting pin, to the end of the pattern. The pin fitted into the slot in a plate screwed on the spindle, but this was rather a clumsy arrangement and since we introduced the above drive center it has been used almost exclusively for work ranging from 4 to 15 inches diameter, and from 2 to 4 feet long.

Hamilton, Ont. ADANAC.

Truing Crank Pin on Quartering Machine

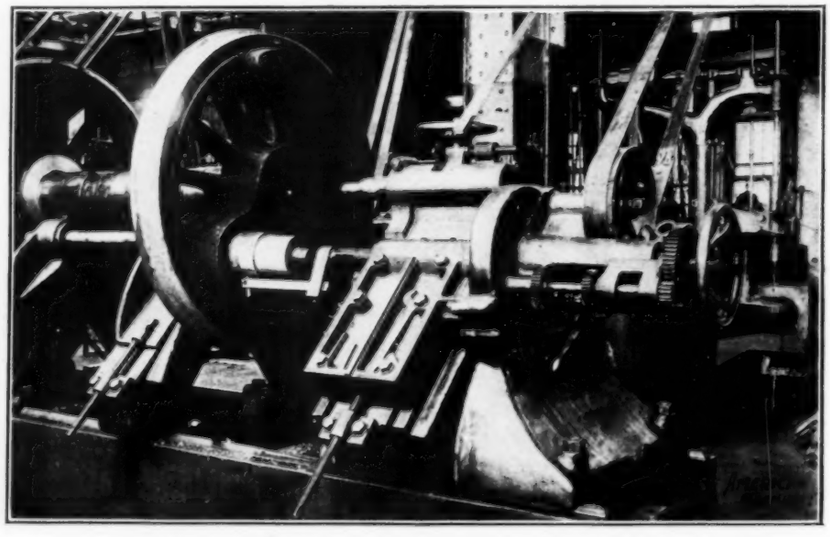
The illustration shows a crank pin being trued up in a quartering machine. It is not always convenient to remove a crank pin and true it up in a lathe, and when it is done in this manner it is expensive.

Prior to the use of this tool we trued our pins up by filing and calipering, which was expensive and very crude, many times requiring five hours for each pin and then the pin was not perfectly round, nor was it always in quarter with the other pin.

The tool shown in the picture was gotten up by the general foreman, W. D. Smith, and by its use the time was reduced to less than one hour and when the pin is trued up, it is absolutely in quarter with the other pin. It is not possible to take a heavy cut with this tool, but on account of the speed of the machine, it is not necessary to take a heavy cut. The photograph shows the tool very clearly and will not require any further explanation.

Danville, Ill. J. H. TINKER.

If a 200-pound man runs upstairs at such a speed as to climb five 12-foot floors in 22 seconds, or even two 12-foot floors in 8¾ seconds, he would be performing work at the rate of one horsepower. This form of exercise, however, is not recommended for the average 200-pound man.



TRUING CRANK PIN ON QUARTERING MACHINE

Discussion of Previous Question

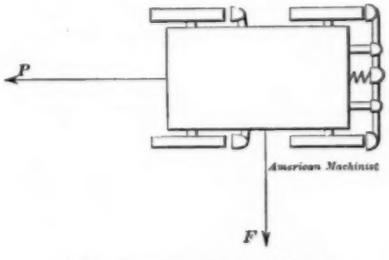
Letters from our readers showing how many men of many minds look upon various subjects opened up in previous numbers

End Motion of a Rotating Journal

The article by L. E. Picolet, appearing under the above heading on page 1112, Volume 33, Part 2, and Professor Sweet's later discussion of it, call to mind some facts that lead me to lay the phenomenon of the end motion of a rotating journal to the relative values of static and moving friction.

It is well understood that no bodies are perfectly smooth and the fitting together of projections and depressions on two surfaces in contact produces static friction. When these bodies are forced to slide over each other, these irregularities either break off or cause a vibration vertically so that the projections and depressions pass over each other and this results in the moving body having an intermittent "floating" action; in air if unlubricated and on oil if lubricated.

In Mr. Picolet's article he discounts



THE EXPERIMENTAL WAGON

this matter of change of friction, but several years ago Prof. N. G. Jukowski, of Moscow University, Russia, demonstrated an experiment in a lecture which I think shows this point exactly.

A small wagon supplied with a brake was rolled over the surface of a table, being driven by a force P, in the illustration. A force F was applied to the wagon which would tend to slide it laterally. If the wheels were free to rotate, no value of force F between zero and a certain limit could make the wagon change its straight path. One might roll the wagon any number of times back and forth, but not the slightest deviation could be detected until the lateral force F was increased to a certain value and this was equivalent to the weight of the wagon multiplied by the coëfficient of static friction. Then, all of a sudden, it would change its path.

But when the brake was set and the wheels were forced to slide instead of roll, the slightest lateral force F (many times less than the frictional resistance) would displace the wagon from its straight path, just as was shown in Fig. 2 of Mr. Picolet's article.

The explanation is that while the wheels are rolling, they always are in continuous contact with the surface of the table. The wheels are not smooth, nor is the surface of the table, but they never actually part from one another; the wheels lock into the surface of the table and hence there is no opportunity for static friction to be changed into sliding friction, and the experiment shows that it is not.

According to Jukowski's deductions the phenomenon of end motion cannot take place when roller bearings are employed.

West Allis, Wis. A. J. LOGUIN.

Making a Hob

In answer to H. M., who asks on page 222 whether the form of hob which he describes can be cut on the Brown & Sharpe milling machine, I should say yes, not absolutely but practically correct. There are various minute errors which would creep in through variations in hardening and inability of the workman to set up his work to absolute perfection, but it would be almost impossible to detect them in the finished product. In 1903 I built a fixture and developed the hobs for hobbing spiral gears for A. B. Dick & Co., of Chicago. The designer of the fixture was R. F. Dow.

We tried several different ways of making the hob cut, but the only one that gave satisfaction was to flute it in the same manner as an ordinary worm-gear hob; at right angles to the spiral of the teeth. If the hob is made as in Fig. 1 it must be set so that a plane passing through the center line of the work and the line a will be at right angles to the axis of the hob and the lines b and c passing through the root diameter of the teeth will be farther away from the center of the work than they should and will not cut to the proper depth, resulting in a lengthening of the form on the tooth, making it too thick at the top. This could be avoided by running the hob back and forth on its own axis, but such a method would be too slow to be practical.

The layout given in H. M.'s problem is wrong in another particular in that the number of teeth to be cut in the gear and the number of teeth in the hob should not contain a common factor. In hobbing, as in cutting spur gears on a generating machine, the working surface of the tooth is produced by a number of cuts, which, taken as a whole, approximate the correct outline and the greater the number the closer the work. With a hob the number of surfaces making up the side of the tooth is governed by the number of teeth occupying different longitudinal positions, which fall wholly or in part in an annular ring on the hob as wide as the circular pitch, or

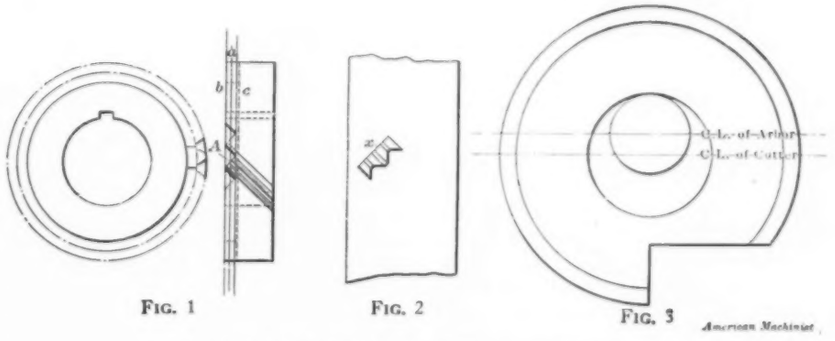


FIG. 1 FIG. 2 FIG. 3

DIAGRAMS RELATING TO MAKING A HOB

in other words, the number of teeth on the hob that cut through the same tooth space without tracking.

In the case given $32 \div 12 = 8 \div 3$ so that the same teeth will cut in the same tooth space every third revolution of the hob and there would be eight teeth of the hob which would go through that space. If the number of teeth in the hob was 31 or 33, there would be a different set of teeth cutting at each revolution for as many revolutions as there were teeth in the hob. With the same end in view, we should avoid hav-

ing a common factor in the number of teeth and the number of flutes in the hob.

In working up the hobs, which we developed, I first made a hob the exact duplicate of the gear to be cut, cutting the teeth with a regular Brown & Sharpe gear cutter on a universal milling machine and fluting it at right angles to the spiral. I did not bother to back it off because that would have been an expensive operation and I could worry through with what I wanted without. This hob was then set up to drive from the spindle of the machine and a blank the size of the hob for the work was placed on the spindle of the fixture. With the machine geared up to cut the spiral of the work hob and set at the correct center distance, the small hob was slowly fed into the blank far enough to get the full form of tooth desired. From this I developed the cutters used in getting the final result. Enough of the blank was cut away to leave two teeth projecting, as shown in Fig. 2, and these were backed off by hand to a good cutting edge.

Going back to the milling machine this cutter was set up to the spiral of the work hob between centers and the table turned to 45 degrees. Two cutter blanks were fed through the space forming them to the exact shape required. One of these was fluted like an ordinary eccentric relieved cutter; the other was cut out as shown in Fig. 3, and by dropping it below the center to give relief, it was used as a fly cutter to make a relieving tool for the first one, and afterward to back off the hobs. In forming up these cutters we were careful that the center x of the space between the two teeth at the cutting edge should come to the center of the arbor when it was exactly vertical with the center line of the index centers.

After relieving our cutter we proceeded to cut the hobs with it in the usual way. To relieve the cutter we had no spiral backing-off attachment, so, after fluting the hob was put back in its first position, the index head tipped down about five degrees, and, with the spindle locked, the fly cutter was used to plane out the relief feeding by hand. The hobs will not work well unless relieved, but if relieved, when sharpened, will not hold their size, the teeth narrowing as they are ground back. They can be ground back ⅛ inch, however, without changing over 0.0015 inch, which would not cause much trouble with an involute tooth.

For H. M.'s work he can gear the spirals as follows: For the worm, lead, 5.952; worm, 100, 56, 24, 72 screw; or, direct to spindle of dividing, head, spindle 100, 24, 40, 28 on screw; for the gear, lead 2.193; worm, 24, 56, 44, 86 on screw; direct, spindle 86, 28, 40, 56 on screw. Our fixture was built on a Pratt & Whitney No. 2½ hand screw machine. The work was first class although we had to make a mongrel tooth on account of the center distances in which the gears were to be used having been predetermined by other things.

Hartford, Conn. E. A. JOHNSON.

Machining Punch Presses

Referring to an article at page 915, Volume 33, Part 2, describing some methods of the Willard Machine and Tool Company, in the construction of power presses, a method of machining press frames and slides which I have been acquainted with for many years may interest some of your readers.

The machine-work description in the above mentioned article refers to setting up in special fixtures and planing, an alternative method consists of milling operations on a double-spindle vertical machine using double angular cutters for machining the V-surfaces; this practice has always appeared to me as having special merits as regards finish, producing both satisfactory and economical results. It is quite possible for one man and a boy to take care of three machines on press frames.

In operation, a press frame, Fig. 1, is milled at one setting on the front surface F, the back and seat for V-slip F', the recess for caps F'', and the facings for the crank-shaft journals, shown cross hatched. This comprises the whole surface-machine work of the frame itself, with the exception of the bed, which is obviously a planing job, and which experience teaches us it is better to leave rough until the slide has been bedded. Before removing the press frame from the platen of the milling machine, however, the V-slips are clamped in position and milled with double angular cutters as shown in Fig. 2. Several V-slips are cut to the required lengths, from one long casting which is first machined on two sides and the back in readiness to be clamped in the press frame, for milling.

The method of dealing with the slides is somewhat similar, two slides are cast together as shown at Fig. 3, set up on the two-spindle vertical miller, and finished on all faces marked F, in Fig. 4, a double angular cutter being used for machining the V-surfaces as illustrated. On this operation much time is saved as against setting for planing, several castings being machined at one traverse of the machine platen.

An item in connection with the V-slips for the slide, is the necessity of counterboring or opening out the screw holes from the back, as it is found by experience that these holes frequently require easing a little one way or another for the screws after the slips have been scraped and the slide bedded into position. This is obviously more easily accomplished if the holes are slightly opened out from the back to within say ⅜ inch from the front. Fig. 5 is a section through the slip, and shows a clearance hole for the screw opened out. Allowance for adjustment for wear is another reason given for side clearance in the screw holes in the slips; again, care must be exercised in not elongating the holes in the wrong direction, as would be the case if the holes were to be drilled with too much clearance entirely through the slip, lateral movement of the slip would occur when the slide was in motion, thus tending to loosen the screws, owing to the fact that no steady pins are permissible in view of adjustment required for wear.

Glasgow. O. SAVILIAN.

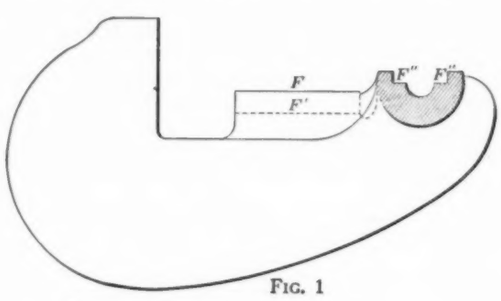


FIG. 1

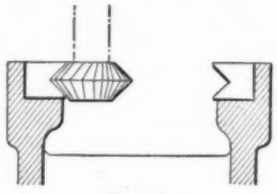


FIG. 2

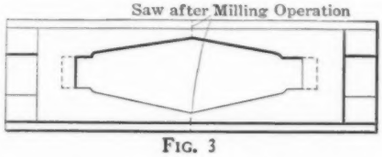


FIG. 3

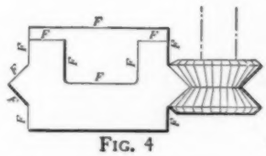


FIG. 4

FIG. 5

American Machinist

MACHINING PUNCH PRESSES

Hardening Tool Steel

Your correspondent S. A. Leckie, on page 265, Volume 34, confidently recommends the use of common table salt as a temperature indicator in hardening tool steel, claiming advantages such as correct hardening heat, no scale, freedom from cracks, and 50 per cent. longer life

for the tools; and I agree with him in all this, but he would procure even better results if he would use a reliable salt, or mixture of salts, with a definite melting point at a somewhat lower temperature than that of common table salt, which usually melts at about 1470 degrees Fahrenheit. If the salt is pure its melting point will be definite at 1472 degrees Fahrenheit, but many varieties of table salt are by no means pure, and some of these have a melting point 100 degrees away from that of the pure salt, which makes all the difference between good and bad hardening.

A salt with a melting point that may be relied upon as accurate at about 1400 degrees Fahrenheit gives excellent results, particularly if applied in the form of a paste such as the Brearley Sentinel Paste which can be obtained to melt at any temperature to suit the work in hand. This paste needs only to be streaked or painted on the tools, hot or cold, and remains as a plainly visible white patch or streak until the indicated melting temperature is reached, when the patch disappears instantaneously, and the tools can be quenched out. If the size or shape of the tool requires that it be left in the fire or furnace for a lengthy period, then to avoid overheating, two pastes should be applied, one with a melting point at the minimum temperature at which it is required to harden, and one with a melting point somewhat higher, which, of course, must not be allowed to melt.

This same method of indicating temperatures may be utilized when annealing. All that one requires is a notched bar, and the salt in the form of paste which sticks to the bar when painted on. Pastes of varying melting points may be streaked on the different notches, and the bar can be directed to any part of the furnace at will, allowed to attain the same temperature, withdrawn, and examined to see on which notches the salt has disappeared. The notches should be numbered, and a record kept of the relation of the melting point to the number on the bar. In this simple manner one can easily regulate furnace temperatures to 50 degrees.

Sheffield, England. W. H. D.

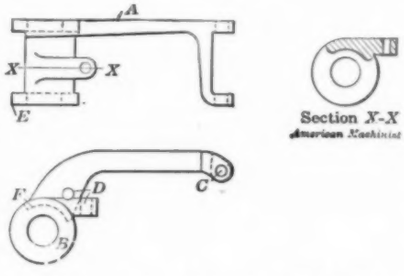
Piercing Dies and Drill Jig for Brass Casting

Under the above title there appeared an article by myself, on page 993, Volume 33, Part 2, describing the tools used to pierce and drill the holes in the piece shown herewith. On page 75 of the current volume is a criticism of this article by Aron Lawrence, of Detroit, which, to say the least, is none too gentle. The latter gentleman states that the piece in question is a "simple little brass casting" which could be handled more expeditiously and more cheaply by providing one jig for drilling all the holes, "if a little thought had been devoted to the matter."

Now I would like to suggest that it is not at all improbable that considerable gray matter had been expended on this subject before these tools were made. In fact, perhaps more attention had been given to it than Mr. Lawrence has been able to give from a reading of the article; so, in justice to myself, I feel called upon to explain more fully several points about these tools, which received no detailed attention in the previous article, as some of them seemed perfectly obvious.

In the first place, in answer to the inquiry as to what becomes of the slug punched from the top flange *E* in the figure herewith, I will say that it precedes the punch to the bottom flange and through it, actually acting as the end of the punch in piercing the second hole. This method of piercing through two thicknesses of metal with one punch leaves a very good hole. The idea is not new, but is well known to those having any considerable experience in punch and die construction and is extensively used when exact alinement between the holes is an important consideration.

Now, referring to Fig. 2 on page 933,



THE PIECE TO BE PIERCED AND DRILLED

Volume 33, Part 2, showing the punch and die for piercing the large holes, it will be seen that the lever *C* is made very heavy and that it presses the piece securely against the die. This is done because the relation of the hole *B* and surface *F* is very important, and the heavy pressure exerted by the lever *C* tends to swage out any irregularities in the surface *F*, against the face of the die, locating the work accurately. This feature could not easily be incorporated in any jig designed for drilling all the holes at once. It will be obvious that piercing these two holes at once insures better alinement than it would be possible to secure by drilling.

Referring to Fig. 3, in the same article, it will be noted that one end of the piece is located by the holes pierced in the previous operation, as explained in the article, while the other end is located against a gage plate *A*, and the piece held in place by the fingers. Thus it will be seen that there is absolutely no chance for the center distances between holes *B* and *C*, Fig. 1, to vary. This might easily happen while drilling, on account of the work shifting by reason of the pull of the large drill with the exceptionally tough nature of the casting and the light section surrounding the holes.

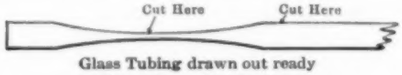
We now come to consider the jig, Fig. 4. Mr. Lawrence objects to the design of this, quoting the well known maxim that the strain of drilling should not be directed against the clamping devices of the jig; but this, as well as nearly all other rules, has its exceptions and in this case I see no alternative unless we use a large jig with a leaf to receive the thrust. Furthermore, the hole is so small in comparison with the clamp that no objection can be raised against drilling it in this direction when we consider the other excellent point in the design; that is, utilizing two holes already pierced from which to locate, which is the most approved and most accurate way of locating work in any kind of a fixture. We also utilize the only finished surface of the casting in locating, which insures the holes being square with each other.

The strain of drilling the other small hole is borne by the large locating stud which, from its large size and being fixed securely in the frame of the jig, is very solid and substantial and is as good a support as could be desired.

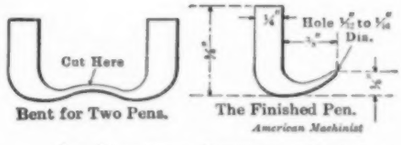
Philadelphia, Penn. T. H. HARRIS.

An Improved Recorder Pen

I have just read an interesting article on page 413, Volume 34, describing a homemade pen for a recording chart, and the difficulties encountered in getting it to operate satisfactorily, and how success was finally attained.



Glass Tubing drawn out ready to be cut to make Two Pens.



AN IMPROVED RECORDER PEN

On several occasions I have made such pens for recorders and after experimenting with both the V-shaped metal pen and the capillary glass tube form pen, I finally came to the conclusion that the glass pen was easier to make; much more satisfactory in use than any other; never affected by any ink that might be used; operated more smoothly and gave a more sensitive and accurate record.

There is one objection that can sometimes be properly urged against the glass pen and that is its weight, for generally it will weigh more than a very light sheet-metal pen and so in cases where

the pen has to be moved very rapidly in making the record, the inertia of the glass pen is against it.

A glass pen can be made easily in less than five minutes in most cases after the few necessary appliances are gathered together and in making one I prefer to take a short piece of light glass tubing, about a foot long, with an outside diameter of ¼ inch and a bore of 3/16 inch, such as can be readily obtained for a few cents in about three-foot lengths at any wholesale drug or chemical supply store. Heat this in a gas, alcohol lamp flame, or a gasolene torch, about two inches from the end and while so heating it pull the end gently from the balance of the tube in such a manner that the tube will be drawn out lengthwise and to a small diameter, say to a bore of about 1/16 inch, then give it the proper bend to make two pens, allow it to cool and then cut carefully with a saw file, as indicated in the sketch. Now when this has been done, it will be found that the small end of point of the pen has sharp edges, and to overcome this reheat the point carefully in the flame till it just softens or melts a little, when it will be found that this sharp edge becomes beautifully rounded, and will slide almost without friction over the surface of the paper.

A thread of sewing cotton passed through this pen and cut off flush with the point is an advantage. These pens may be very quickly and easily attached to almost anything with sealing wax, or in some cases with a little lump of beeswax for temporary use.

FREDERICK W. SALMON..

Burlington, Iowa.

Taking an Awkward Measurement

It often happens that, in making a sectional die, the toolmaker runs up against the awkward proposition of measuring to a corner where it is impracticable to use either depth gage or micrometer in the ordinary way. Such a proposition with its solution is shown in the accompanying cuts.

Fig. 1 shows part of the plan of a compound die for a pole tip, with two of the sections A and B in place; C is the cast-iron shoe into which the sections are fitted and E is a piercing punch.

Now, A having been ground and fitted, it is required to get the width M of the piece B. This, of course, must be the same as the distance from F to G. The best way to measure this is shown in the diagram, Fig. 2. Here we see the section A with a parallel clamped by suitable means to the face H and also a truly ground plug resting against the parallel on the one side and the face L on the other. A moment's inspection of the diagram will show that distance M is made up of $D + R + X$. It is an easy matter to measure D with a depth gage; R, we can get by taking one-half the diameter of the plug, and X is the side of a small triangle of which we know one side R and can get one angle. This angle $\frac{O}{2}$ is half the angle O, which can be measured with a protractor, and X is arrived at by multiplying R by the cotangent of the angle $\frac{O}{2}$. The following example which I met the other day will show the working of this method. The angle O was found to be 35 degrees 10 seconds and $D = 1.083$. The diameter of the plug was 0.1910, so that $R = 0.955$. The cotangent $\frac{O}{2}$ (17 degrees 35 minutes) $= 3.1556$; multiplying this by R we get $X = 0.3013$. Then $M = D + R + X = 1.083 + 0.0955 + 0.3013$ $\therefore$ $M = 1.4798$, which is the width to which section B must be ground.

The principle underlying the above method is, of course, not new. Frank H. Scheu's excellent article on the "Measurement of Dovetails," that appeared on page 650, Volume 31, Part 1, is based on this principle, which the average toolmaker does not seem to be as well acquainted with it as he should be.

Peterboro, Ontario. M. H. P. A.

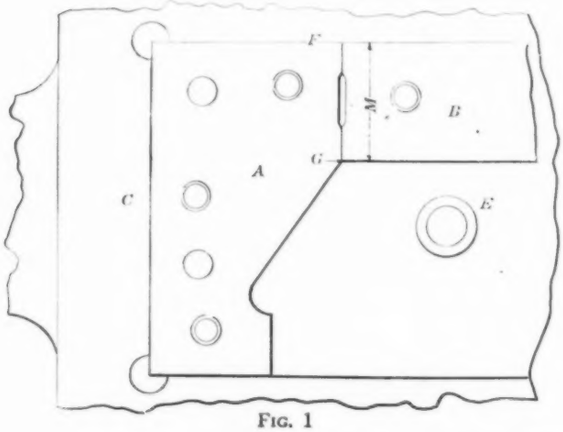


FIG. 1

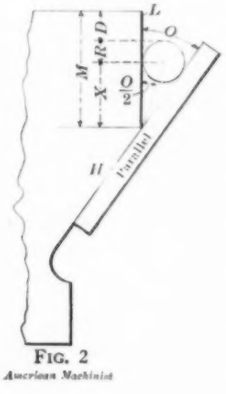


FIG. 2
American Machinist

TAKING AN AWKWARD MEASUREMENT

Self Gaging Piston Head Reamer

On page 365, J. H. Harris, under title of "A Self Gaging Piston Head Reamer," gives the formula: $C = A\ cot.\ D$. This should be

$$C = \frac{A}{2}\ cot.\ D.$$

D is the angle of taper, A is the difference in diameter of reamer before and after grinding, and C the amount to be ground from the collar.

This is shown in Fig. 1, where D is really half the total angle of taper. If D is taken as the total angle of taper of the reamer, Fig. 2, the formula will be:

$$C = \frac{A}{2}\ cot.\ \frac{D}{2}.$$

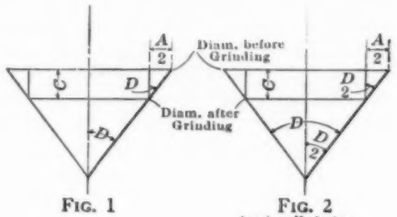


FIG. 1 FIG. 2
American Machinist

SELF-GAGING PISTON-HEAD REAMER

Chicago, Ill. M. JACKER.

Rational Section Lines and Drafting Standards

The "rational system" of section lining which J. H. Harris advocates on page 548, is open to criticism in a number of respects. First, it is entirely too highly specialized for general use. This fault is natural enough since he designed the system for his own peculiar needs. Second, the practice of indicating grades of material by means of hatchures is of very doubtful value. Most authorities agree that so long as there is no standard system of representing material in section, no dependence should be placed upon such a method of indicating the quality of material, and to attempt a still greater refinement—as Mr. Harris suggests—seems like inviting the possibility of error. Finally, the character of the suggested hatchures is open to question. The practice of using two lines of different weights in indicating a material in section is calculated neither to save time nor to promote temperate speech and, moreover, lining of this character tends to give undue emphasis to the part. In the illustration showing a comparison of the "rational method" with the usual method this over-emphasis may be easily noted, and it may also be noted that if a trifle more care had been exercised in ruling by the usual method, to differentiate between the parts, perhaps the method advocated by Mr. Harris might not appear to such great advantage.

But whatever may be said for or against this rational system, it serves admirably to focus attention on the fact that, not only in systems of hatchures but also in other ways, is drafting deplorably lacking in uniformity. An examination of a large number of textbooks and articles on drafting-room practice reveals the fact that there is an entire lack of agreement in systems of hatchures for representing materials in section and in the character of the lines in use on drawings. There is no end of so called standards, but there is no agreement among draftsmen as to which one of these standards is the real standard.

This condition is not hard to account for. As soon as a draftsman fails to find what he needs in the way of standards—as in the case of Mr. Harris—he at once sets about creating them. The result is that drafting is not a uniform language, but a language of dialects and colloquialisms. Out of the existing so called standards and systems of drafting, it should not be a very difficult task to find *one real standard* which would have merit in its composition, and if draftsmen would generally agree to use this standard, the present unfortunate lack of uniformity would cease to exist. The difficulty lies not in finding the suitable standard so much as it does in getting it adopted.

Iowa City, Iowa. F. G. HIGBEE.

An Emergency Pipe Wrench

On page 32, Volume 34, the monkey wrench used as an emergency pipe wrench by inserting a small hardened set screw is shown. The set screw is very hard on a pipe on account of the small area in contact, and hardened set screws are not always on hand. By using a round file (or part of one) between the wrench jaw and pipe, having the file parallel with the pipe and jaws adjusted so it will roll into gripping contact, a very firm grip is secured and even plated pipe can be gripped without marring it to any extent.

Ontario, Canada. A. B. C.

How Would You Turn This Job?

One simple way in which the job shown on page 650 can be done is with what used to be called a "wabble" center. The piece is first centered and roughed end to end, leaving a slight amount for finish, say 1/32 inch.

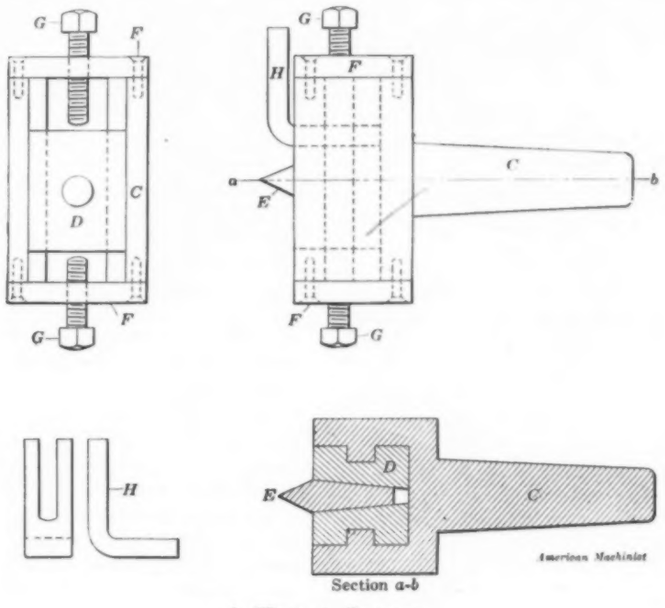
A center should be made which either slides or rocks one-half the difference between 1 7/16 and 1 3/16 on each side of the true center, but in one plane only. To produce good work it must have no shake in the plane at right angles to its movement.

A good way to make a wabble center is shown in the line cut. This one is adjustable for various ratios of major and minor axes.

The body *C* is made of machine steel and, if there is much work to do, better be casehardened. The head of *C* has internal tongues which are a sliding fit in the grooves in *D*. The sliding block *D* can be made of good close-grained hard cast iron. The hole for the center *E* should be bored and reamed after the block *D* is fitted to *C*, the end pieces *F* are screwed in place, and the set screws tightened to hold *D* in central position. The center *E* should be short so as not to cause *D* to bind in *C*. The set screws *G* should be provided with check nuts or some other device to hold them when set.

The wabble center is set in the headstock. The set screws *G* are then carefully set to produce the ellipse required. It is best to take a cut over a piece of old shafting first to get the "hang" of the device. Set the tool at the center. It is understood that an ordinary center is used in the tailstock and for taper work the tailstock can be "set over." The device will turn an ellipse but wagon spokes are not generally elliptical.

New York. E. A. DIXIE.



A WABBLE CENTER

Value of "E" for Springs. Effect of Weight

Referring to the very interesting articles on page 147, by G. F. Summers, and page 268 by R. S. Bayard, in regard to the coefficient of elasticity for helical springs:

Mr. Summers is not very definite in regard to the manner of loading and taking his readings, and Mr. Bayard raises the question of the deflection of the spring due to its own weight.

From Begtrup formula, AMERICAN MACHINIST, August 18, 1892, and in eighth edition of Kent on page 396:

d = Diameter of wire;
D = Diameter of spring;
F = Deflection of one coil;
E = Torsional modulus of elasticity;
P = Load in pounds;
L = Total length of coil.

$$F = \frac{8\,P\,(D-d)^3}{E\,d^4}.$$

Let

dl = Length of any elementary portion;
p = Weight of spring per unit of length;
l = Length of spring above the element considered;

Then let dF be the deflection of the element of the coil, which has a length dl.

If there is no other load on the spring than its own weight, $P = pl$ for the element considered.

Considering the length dl;

$$\text{Deflection} = dF = 8\,\frac{pl\,(D-d)^3}{E\,d^4}\,.\,dl, \text{ or } \frac{8\,p\,(D-d)^3}{E\,d^4}\,l\,dl;$$

$$\text{Integrating, } F = \int_0^L dF = \frac{4\,pL^2\,(D-d)^3}{E\,d^4}$$

$$\text{or } F = \frac{8L\,(D-d)^3}{E\,d^4}\,.\,\frac{pL}{2}.$$

But pL is the total weight of spring. This means that half of this weight of the spring itself should be considered in the total load, if the spring was first measured lying uncompressed on the ground.

It seems to me though, that the simplest and best way to get these data would be to set up the apparatus for loading the spring; take an initial reading with the spring slightly compressed as a

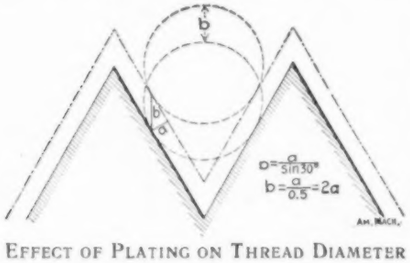
starting point, and note the increased deflection caused by the added load as it is added.

If the load would be applied in two or three equal increments, the spring deflections for each increment would be equal, and this would serve as a check. For, so long as the elastic limit is not exceeded, the deflections are directly proportional to load and it doesn't matter where you begin to count, so long as you count the deflections caused by a given load.

Marion, Ind. V. H. SNOOK.

The Cadillac Thread Allowance for Nickeling

I read the article by Arthur D. Elmer on the "Merits of the Cadillac Form of Thread," on page 211, with a great deal of interest, and think he has given us some useful data on a basis to eliminate a lot of our thread troubles. In summing up, I reached the conclusion that, in adopting this form of thread, the small manufacturer who buys stock sizes of brass and steel rod and tubing, and does not use enough of any one size to have



EFFECT OF PLATING ON THREAD DIAMETER

it drawn or rolled to a special size at a reasonable price, would find it necessary to have his taps and dies made special, either in his tool room or by the manufacturers of taps and dies, but I think the results would more than justify the extra expense incurred.

We were having considerable trouble with our threaded parts, both in the shop and the assembling department, for the reason that a large percentage of our threaded parts were nickel-plated before assembling and an extra allowance must be made for this when making these pieces. At first thought it would seem impossible to make any definite and correct allowance for such a variable factor, but from extended observation we have found that pieces ranging from ½ to 1 inch diameter and 20 to 32 threads per inch require an allowance of from 0.003 to 0.004 inch in the diameter for a single piece. Where both pieces are to be plated, double this amount must be allowed. An inspection of the illustration will show how any slight variation on the side of the thread is multiplied in the diameter of the piece. If the thickness of the nickel plating is but 0.0005 inch, measured at right angles to the surface, the difference in the diameter is four times this amount, or 0.002 inch.

Like most small manufacturers, we were in the habit of buying our taps and dies from the makers of them, specifying United States Standard for the form of thread, and they would be furnished with the die to standard (?) diameter, and the taps 0.004 to 0.005 inch large for wear and differences in pitch. When making threaded parts we would naturally make the nuts first and fit the threaded pieces to the nuts, closing the die until we had a loose fit, and especially loose when both parts were to be plated. Now right here is where our trouble began, for the rod being standard and the die closed as much as 0.010 inch below, gave the die too much stock to take off.

To remedy this condition we were compelled to take a cut off the rod before running the die on, but we still got a poor thread because, the die being closed so far, the cutting edges and clearances were not presented to the work in the proper position. The solution was easy enough, for we adopted the practice of always making the die standard and making all the allowances in the diameter of the tap, carefully noting whether one or both pieces were to be plated, and our gages were made accordingly. The allowances on a 13/16-inch 24 United States Standard thread tap made recently were: For difference of pitch and wear of tap, 0.004 inch; plating one part, 0.003 inch; plating one part, 0.003 inch; total, 0.010 inch.

The measurements were made with a regular 1-inch micrometer caliper and the 3-wire system, using the formula on page 34 of the AMERICAN MACHINIST Handbook. Since adopting this practice a large part of our thread trouble has disappeared. In the future we will use the Cadillac form of thread and, no doubt, get still better results.

Philadelphia, Penn. E. A. ERMOLD.

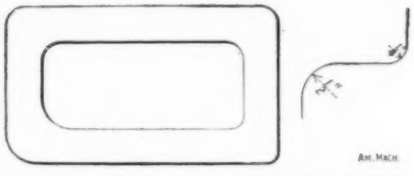
The Saver That Will Save

C. A. Clandery, on page 394, comes back at me on the "Time Saver" that did not save, and in reply I have to say that if others try and use my suggestions with as little regard to what I say and show, then all my sixty years of writing for the technical papers has been a lifetime of uselessness.

It seems he made his instrument triangular, which would have been all right if he wanted to round the points of triangles, and dead wrong for rounding corners. I made mine a parallelogram because that was the shape of the piece I had to make it of. In use I find it better than square, as I can use the long side for straight lines, which I ink in at the same time I ink the corner. In cramped places I use the end, when it will go in and not smear the previous work. The rectangular is right, as the round corner will blend with both straight lines and thus discount the compass, not in time only but it makes a more perfect blend.

Mr. Clandery not only made his tool triangular in a sense, but omitted the real feature that makes the instrument a success—the central opening with the corners of it round internal corners, corresponding with those outside; except that while the radii of the outside corners are about 1/64 inch smaller than ⅛, ¼ inch, etc., the radii of the corners inside are about 1/64 inch larger than the ⅛, ¼ inch, etc.; this to allow for the half thickness of pencil and inking pen. With the outside and inside corners, the instrument can always be used with the pen on the upper surface and one end,

My steel plate is a little over 1/32 inch thick, but I see no reason why it would be any more trouble to use one the same thickness as the common celluloid triangles, and it is certainly no more trouble to run the inking pen up the end, around the corner and along the top, than along the side of a triangle or French curve. The draftsman is a cracker-jack who can do as good a job with the tee-square, triangle and compass, and as quickly is not possible.



THE REAL TIME SAVER AND ITS WORK

This answers the objection as to the tracers finding the centers, as the same instrument is used for drawing, inking and tracing. If not for tracing, the scheme shown by one of your contributors would locate the centers better, or just as well, with this drawing as any other, and a mighty sight better than dodging around with a pair of compasses.

I think if anyone wants to get any good out of my attempts to help them, they will need to get within four rows of apple trees of what I say and show. After some years of use, I find it so useful that I believe it worth republication, Fig. 1. I wonder how your contributor can duplicate the line shown in Fig. 2 in 30 seconds, which I drew and inked in in that time—he to use tee-square, set square and compass.

Syracuse, N. Y. JOHN E. SWEET.

According to analysis, Magnolia Anti-Friction metal consists of: Lead, 78.27 per cent.; antimony, 17.81 per cent.; tin, 3.88 per cent.; copper, 0.04 per cent.; the copper being an impurity. To make the metal the following proportions are used: Lead, 80 pounds; antimony, 15 pounds and tin, 5 pounds.—*Brass World.*

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American Machinist

Condemning Good Machines Because of Poor Operation

Too many purchasers of machinery or apparatus of any kind seem to overlook the fact that the maker of the machine cannot supply the necessary intelligence to operate it.

They make the mistake of putting it into the hands of an untrained man, with little or no instruction by a competent person, and expect good results. When they are not forthcoming, the apparatus is blamed and unpleasant misunderstandings develop all around.

This method always involves a monetary loss, sometimes introduces an element of danger and is almost impossible to account for in some of the plants that are otherwise well managed.

Aside from the question of loss of efficiency there is the perhaps delicate, but none the less real, problem of the duty of being fair to the maker of the machine. Even Shakspere's "damning with faint praise" was flattery as compared with the damage which is too often done to the reputation of good machines because they are not properly used.

Trend Toward Special Machine Tools

The trend toward special machine tools, for repetition manufacturing, tools used for a number of operations or to machine one piece entire, perhaps performing several distinct operations—as milling drilling, tapping, counterboreing, and the like—has been emphasized to us by recent incidents.

A short time ago we saw a very successful use of such special machine tools in a lathe or turning department. These tools had vastly increased the output per man, with a corresponding reduction in cost. The successive steps in machining methods leading up to the building and use of these machines were as follows: First, the use of the ordinary engine lathe; second, a change from the engine lathe to the turret lathe; third, a change from the turret lathe to the special machine tool.

In the last stage each piece of work was gripped by carefully designed, easily manipulated devices, was operated on by multiple tools, one or more for each cut, and many of the operations were simultaneous.

In another place we came across a special milling machine that produced 600 pieces per day, where only 100 had been machined formerly on a standard miller equipped with improved fixtures and high-speed steel cutters. This milling machine in no way resembled any standard type—it was special for the job.

One of the most successful machine-tool designers of this country was asked to investigate a large automobile factory and suggest ways of reducing manufacturing cost. His report in brief was to design and build a line of special machine tools to produce many of the parts. His estimate of the cost of these machines was less than the second-hand value of the standard machines that would be replaced. The saving in floor space would be considerable, the production per unit of time per man would be greatly increased, and the labor cost decreased in some cases as much as 70 per cent.

We present these few facts to show the trend toward special machine tools under the spur of reducing costs.

Military Training for Industrial Life

The closing sentence of an address given by George Westinghouse before the Southern Commercial Congress is: "The present preëminence of Germany in industrial matters arises very largely from the military training and discipline to which each of her citizens must submit." This is an authoritative statement of a conclusion reached by many persons who have studied the industrial growth and condition of Germany, although not an attractive doctrine to Americans.

The industrial and manufacturing expansion of America, which took place in the last decades of the last century, was carried forward largely by men who had seen active military service in the Civil War. To this training in part Mr. Westinghouse ascribes his own success, for in this same address we read: "My early greatest capital was the experience and skill acquired from the opportunity given me when I was young to work with all kinds of machinery, coupled later with lessons in that discipline to which a soldier is required to submit, and the acquirement of a spirit of readiness to carry out the instruction of superiors."

It is a splendid thing for any man to know how to obey, to know how to carry out the instruction of his superiors, to know how to work with others for a common end. This is the thought often intended to be conveyed by the word co-operation. It is a little less harsh to say that a man must coöperate with his superiors than that he must obey his superiors, and inasmuch as it is less harsh, it is less forceful.

We would not attempt to argue in favor of a huge military establishment for the United States, because of its advantage as a training school to transform the green boy of the country and the untrained lad of the city into useful industrial workers. The gain would not be worth the cost. In the case of Germany the advantage to her industries through the training of her young men in the army is but incidental and is not the aim or end of her military activities.

At the same time this advantage is very real, and when considered in view of American conditions, lends considerable weight to the recent statement of President Taft that the introduction of military discipline into our schools would be of greater benefit to the country than the development of athletics as at present carried on.

Machine Tool Builders' Association

The spring meeting of the National Machine Tool Builders' Association, to be held at the Marlborough-Blenheim, Atlantic City, N. J., on May 18 and 19, will present some interesting topics for discussion.

Thursday will be largely devoted to reports of committees, the general committees reporting in the morning, the afternoon being devoted to the committees on the various machines represented.

On Friday the important question of the Department Plan of Machine Tool Arrangement on the Basis of Equipment, and on the Basis of Product will be discussed by F. C. Kent, superintendent of the Pierce Arrow company and others.

"Scientific Development of Shop Efficiency," by F. W. Taylor; "Proper Distribution of Expense Burden," by A. Hamilton Church, and "Employers' Liability and Workmen's Compensation," by F. C. Schwedtman and James A. Emery, make up the remainder of the program.

Efficiency in Convention Management

In these days of scientific management, when efficiency is the watchword on every hand, we are pleased to note that it can be extended to conventions as well as machine shops. One of the best examples we know of was the recent convention of the National Metal Trades Association, and Commissioner Robert Wuest placed himself unmistakably in the efficiency-engineer class.

The papers were well selected, their advance publication was a marked improvement in every way. The manner in which this association has grown, both in numbers and in its breadth of view, is one of the gratifying signs of the times. And it is not saying too much to credit its commissioner with a large share in this development.

Personals

Alex Crawford has been appointed purchasing agent of the Hyatt Roller Bearing Company, Harrison, N. J.

George W. Fogarty, demonstrator for the Fitchburg Machine Tool Company, sailed on April 18 for an extended trip in England, France and Germany.

S. Kahn, who has been chief draftsman for the Kavmor Automatic Platen Press, has resigned in order to establish himself in business in New York City.

William A. Viall, secretary of the Brown & Sharpe Manufacturing Company, Providence, R. I., sailed on April 12 for an extended European business trip.

W. H. Tew has recently purchased an interest in the Carpenter-Kerlin Gear and Machine Company, New York City, and has been elected vice-president of this company.

Victor E. Page, for some years past managing editor of the *Automobile Journal*, has joined the engineering staff of the New Departure Manufacturing Company, Bristol, Conn.

A. H. Burdick has resigned his position as purchasing agent of the General Electric Company to accept the position of treasurer of the Standard Woven Fabric Company, Worcester, Mass.

H. S. Ferguson has recently established a consulting engineer's office in Portland, Me. Mr. Ferguson was formerly chief engineer of the Great Northern Paper Company, Millinocket, Maine.

W. J. Kaup has resigned his position as head instructor, machine department, Pratt Institute, to become production manager of the Westinghouse Electric and Manufacturing Company, Pittsburg, Penn.

Rodman Gilder, secretary of the Crocker-Wheeler Company, Ampere, N. J., has resigned to enter a new field of work. He becomes associated with the brokerage house of Dick Bros. & Co., New York City.

G. W Lillie, until recently superintendent of shops of the St. Louis & San Francisco Railroad, Springfield, Mo., has accepted the position of assistant superintendent of the Oregon Short Line railroad, Pocatello, Idaho.

John J. Grant, who has been connected with the Grant & Wood Manufacturing Company, Chelsea, Mich., is now permanently located in Pontiac, Mich., acting in the capacity of consulting engineer of the Flanders Manufacturing Company.

C. H. Pearson, formerly with the Noera Manufacturing Company, Waterbury, Conn., has accepted a position in the hoist department of the Yale & Towne Manufacturing Company, New York City. Mr. Pearson's field of operation will be in the West.

Willie H. Baltzell, who has been connected with the American Steel and Wire Company for the past 17 years, in which organization his last position was chief engineer of the Donova works, has become chief engineer of the Pittsburgh Crucible Steel Company, Pittsburg, Penn.

Leon B. Lent, for some time past with the Riverside Engine Company, New York City, and an occasional contributor to our columns, has been appointed chief engineer of the New York Blaugas Company, to be in charge of a plant at Brewster, N. Y., for manufacturing "blau-gas."

H. P. Townsend, who has been connected with the E. J. Manville Machine Company for the past three years, has resigned and will now devote his entire time to the products of the H. P. Townsend Manufacturing Company, Hartford, Conn., of which company he is secretary and general manager.

Robert Bosch, of Stuttgart, Germany, inventor of the Bosch magneto, sailed for home on April 20, after a month's stay in this country, during which time he made an extended tour, visiting many of the important automobile and manufacturing plants, as well as the Bosch factory in Springfield, Mass.

L. Renault, president Renault Freres, manufacturers of automobiles at Billancourt, France, is at present in this country. This is Mr. Renault's first trip to this country and he intends to remain until the first week in May, during which time he expects to visit some of the more important manufacturing plants.

W. S. Gorton

William S. Gorton, secretary and general manager of the Standard Welding Company, Cleveland, Ohio, was fatally injured in an automobile accident in his city on April 17, which occurred at a railroad crossing, a locomotive striking his machine and hurling it a distance of some hundred feet. Both occupants, Mr. Gorton and his chauffeur, were practically instantly killed.

Mr. Gorton was born in Waterford, Conn., in 1859 and received a common-school education in New London, Conn. Early in his career he was for four years with the marine department of the United State Coast Survey, and later acted as an assistant engineer in cable-railroad construction in Eastern cities. He then became interested in electrical work and became associated with the Standard Tool Company, of Cleveland. In 1899 the Standard Welding Company was organized, since which time Mr. Gorton acted in the capacity of secretary and general manager.

The New Lea Milling Machine

By Ethan Viall *

A combination vertical and horizontal milling machine for a wide range of work.

Automobile practice applied to a machine tool.

Hardened bearings for the work spindle, with soft revolving parts.

Only three grease cups needed for lubricating the entire driving mechanism.

*Associate editor.

The manufacturers' aim in designing the machine shown in Figs. 1 and 2, was to make a miller that could be quickly changed from a vertical to a horizontal, that would be sufficiently rigid when used in either position for the heaviest kind of work within its class, and also by means of a high belt speed and the large number of steps on the cone, a machine that would run slow enough for driving a large-sized cutter on steel, or fast enough for a small end mill on brass, and at the same time have plenty of belt power.

The Drive

The cone pulley, as shown in Fig. 3, is mounted on two imported Hess-Bright ball bearings; both ends protected by means of felt washers and each lubricated by a grease cup. On each bearing the grease entirely surrounds the bearings and the maker claims that his experience in the automobile business has taught him that for such work as this, if the proper sizes are used, these bearings filled with grease, will run indefinitely without showing any wear whatever.

Fig. 1. Front and Side View of Lea Milling Machine

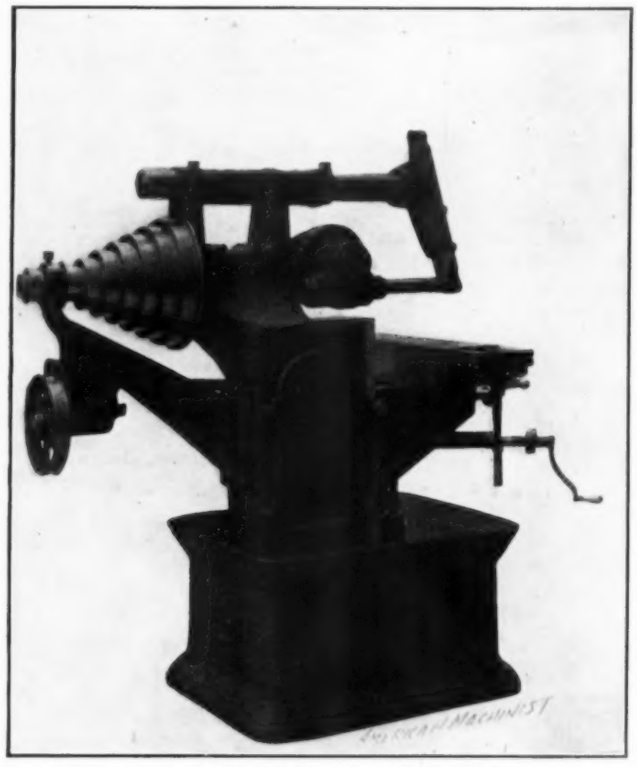


Fig. 2. Back and Side View of the Machine

The Head

The head slides in and out of the column about 9 inches and where it goes through the two uprights the casing is solid, but in the center it is slit and drawn up with two ¾-inch bolts, giving ample holding power under any conditions. The sleeve of this head is 5 inches in diameter and is fitted on one side at an angle of 45 degrees, with a taper-sided keyway and a key which can be drawn in and out by means of the nurled nut shown on the side of the machine. Bringing this key into the keyway before the bolts are tightened, brings the head to zero position on the scale and holds the spindle in the right position for ordinary horizontal milling with the spindle at its lowest position.

The over-hang arm is of ordinary construction, but it has two brackets, one of which supports the extreme end of the head when cutting within the vertical or angular position of the spindle. This adds very much to the rigidity of the machine, and in fact it seems to be as solid as a regular vertical-spindle type. It will be noted that the head swivels in addition to the sleeve, and that any position may be obtained even to making the spindle horizontal and parallel with th- table. The main spindle is driven by two pair of hardened-steel spiral gears, also running on Hess-Bright ball bearings, as shown in Figs. 4 and 5. This head is geared two to one, allowing the cone to make two revolutions to one of the spindle, and thereby giving sufficient power even with the 1¼-inch driving belt used. The main bearings of the spindle are conical and made at an angle of 20 degrees, hardened and ground and then forced into place in the head. The spindle is of steel, hardened and ground both inside and out; is fitted to use an arbor in either end and has a No. 9 Brown & Sharpe taper. On each end of this spindle is placed a cast-iron conical sleeve fitting the bearings and adjusted by nuts on the outside ends of spindle. By this construction end thrust is taken up without

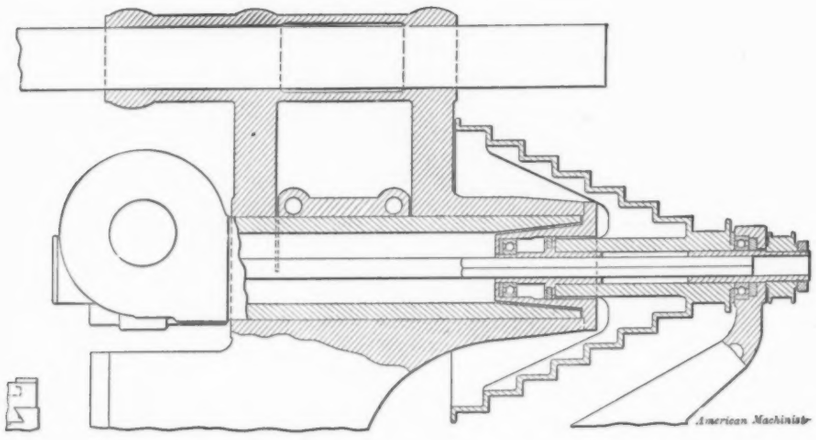


FIG. 3. DETAILS OF THE CONE-PULLEY BEARINGS AND THE HEAD

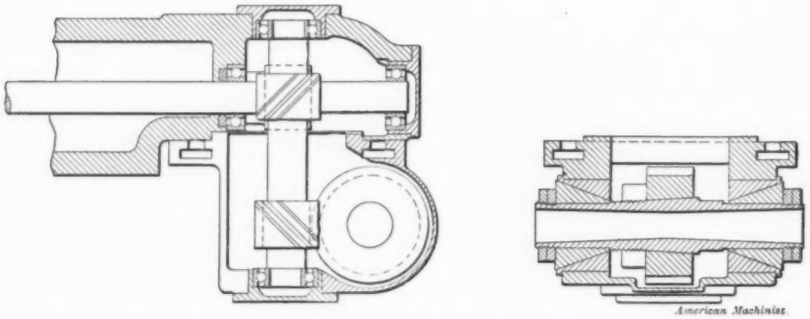


FIG. 4. DETAILS OF THE HEAD AND THE WORK-SPINDLE BEARINGS

making additional thrust collars necessary, and the bearings are instantly adjusted by screwing up the collars on one end. This combination of cast iron and hardened steel is considered by the maker, after long experience, as the best possible for bearings on machine tools. The head is doweled in both a vertical and horizontal position, so that it is necessary to use the graduations only when cutting at an angle. These bearings are made the reverse of the usual practice, namely, having the stationary sleeve hardened and the revolving parts soft, and the reason for doing this is that with this construction if the sleeves are hard enough to resist wear, the machine spindle remains perfectly in alinement.

THE SQUARED DRIVING SHAFT

The main driving shaft is squared where it enters the hardened nose on the cone pulley, allowing it to slide in and out, which the maker believes, makes a better arrangement than a key. Where this shaft enters the head it is packed with a felt washer. The entire head is lubricated with one grease cup, and after the head is once filled with grease, turning of this cup forces the grease out through grooves in the cast-iron sleeves on both ends of the main spindle and nowhere else, which not only lubricates the entire head but prevents dirt from working into the bearings, as the grease coming out has a tendency to push the dirt away rather than take it in. A feature is that there are but three grease cups to lubricate the entire driving mechanism of this machine. After running one of these machines about 10 days, the head was removed and it was found that the grease was comparatively hard on all parts where it was not in motion, while around the spiral gears and other moving parts it was about the consistency of thick oil. This thin grease was held in by the thicker part, and appears to make an ideal lubricant.

THE BASE

The base is large in size and is fitted with a pan, and when ordered will be fitted with an oil pump. There are few milling machines on the market on which a cutting compound can be used without

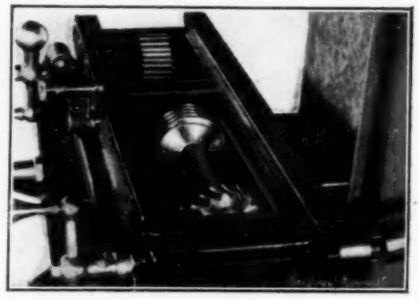


FIG. 6. TABLE-FEEDING MECHANISM

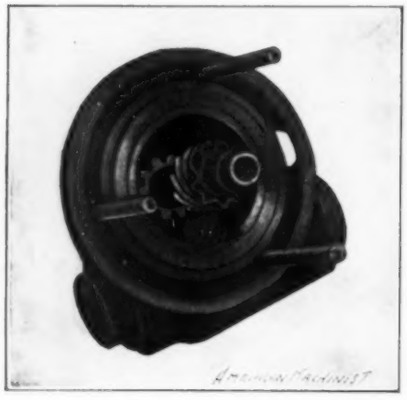


FIG. 5. SPIRAL GEARS IN THE HEAD

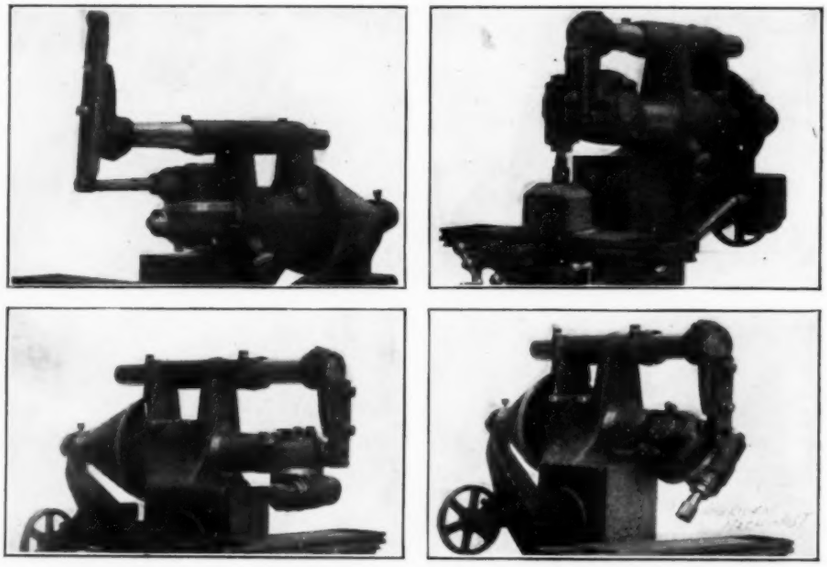


FIG. 7. A FEW OF THE POSITIONS IN WHICH THE HEAD MAY BE PLACED

splashing it over the floor, and it is for this reason that so large a pan is used.

Feed Motion

The table feed is of the rack and worm type, as shown in Fig. 6, which seems to be the best for this class of machine, and in addition to the driving worm there is a gear fitted with both hand wheel and lever for quick return or for hand milling. Both worms in the table run in oil and are lubricated at all times. The feed-change gear is made for six changes of feed, which is all sufficient for a machine of this type.

Fig. 7 shows some of the positions in which the head may be placed and illustrates the method of overhang support for both horizontal and vertical milling.

Summary of Dimensions

The smallest step of the cone pulley is 3½ inches in diameter and the largest 14 inches, intended for a 1¾-inch belt; there are six feed changes, from 0.007 to 0.015; rack feed is 8½ inches; screw feed, 26 inches; working surface of table 7½x22 inches; total length of table, 32 inches; vertical range under spindle, from nothing to 17½ inches; movement of saddle 7½ inches and weight, 1460 pounds.

This machine is built by E. S. Lea, Lamberton and Lalor streets, Trenton, New Jersey.

Novel Type of Rotary Crane

By Alfred Gradenwitz

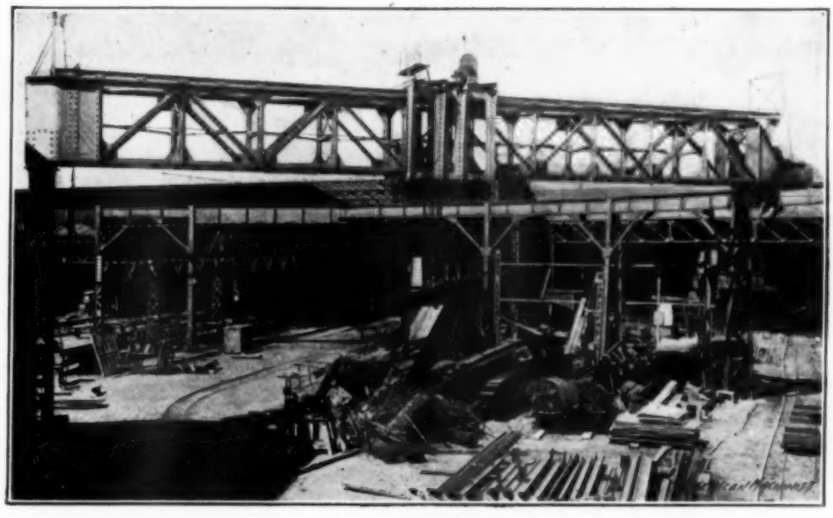
The novel lifting device designed by G. Sohier at Aubervilliers-la-Courneuve, comprises a pivot journal, a circular track, the center of which is formed by the pivot and a crane bridge resting at one end on the pivot journal while the other end travels on the circular track. A small crab travels along this bridge.

This hoisting machine is a perfect substitute for ordinary rotary cranes, while having a number of advantages over the latter. In the first place, the original cost is lower than that of an ordinary crane of the same range and capacity, the saving increasing proportionally to the range. Again, the first cost corresponds to the surface to be covered. In fact, in installing an ordinary crane the frame and foundation will remain unaltered whether a quarter circle or a whole circle is to be covered. In the present case, however, the length of the circular track being proportional to the area to be covered, only the section most urgently needed has to be installed, the track being eventually extended as necessity occurs.

Furthermore, in the case of an ordinary crane the pillar carrying the jib takes up the best position; namely, the center of the surface to be covered. In the present case, however, the support of pivot journal is only in compression and accordingly can be of minimal dimensions or even dispensed with entirely, when the pivot is installed in an angle of a building on the crest of a wall. The larger part, namely, the circular track, is located at the periphery points of support, being arranged as conveniently as possible.

The rotation is effected by a motor which acts on idlers traveling on the circular track. The consumption of energy, especially in starting, is much lower than that serving to operate an ordinary crane of equal range and lifting power, the motor in the present case acting only on the extremity of the lever arm.

The pivot journal is a simple ball abutment. This crane has a bridge length of 66 feet, a lifting capacity of 12 tons, a 3-horsepower motor to move the bridge, a 1-horsepower motor to travel the crab and a 12-horsepower motor for lifting.



A Rotary Crane

What Ails the Pattern Shop

By John R. Godfrey

If the pattern shop around the corner cannot make patterns to blueprints, patterns that are right in every way, there's something wrong with the present-day patternmakers.

A friend of mine has the notion of starting a pattern shop and not to depend on local trade but to draw from a wide area of the country. I shouldn't have thought there was much chance for a pattern shop of that kind if I hadn't happened to receive a letter along the same line from a friend of mine the other day. And if half he says is true, there ought to be a field for a dozen good shops that would handle work for miles around.

For some years I have been buying patterns and I know how difficult it has been to secure satisfactory and accurate ones. I have tried various pattern shops within a radius of two hundred miles, in an attempt to secure accurate work, but I have not been very successful.

Years ago when a manufacturer wished to have machine jobbing work done, he went around the corner to the little machine shop and told the boss what he wanted and the boss made it, after the man had made more calls to give further instructions, and the man paid for it. That is about the way in which a great deal of pattern work is done, although they usually send blueprints which the patternmaker is often unable to read.

The old machine jobbing shop is no longer doing a profitable business, but out of it has come the shop which makes a specialty of jobbing work. The manufacturer does not go around the corner to the machine shop any longer; he sends his blueprints five hundred miles to a kind of shop mentioned, for he knows they can read blueprints and that he will not have cause for complaint. We believe this can be done in pattern work.

The newer gasolene motors with cylinders and upper half of crank case and water jacket *en bloc* require patterns which are complicated and require accurate work. Nine out of ten pattern shops would refuse to take such a job; neither the boss nor his men are capable of making such a pattern.

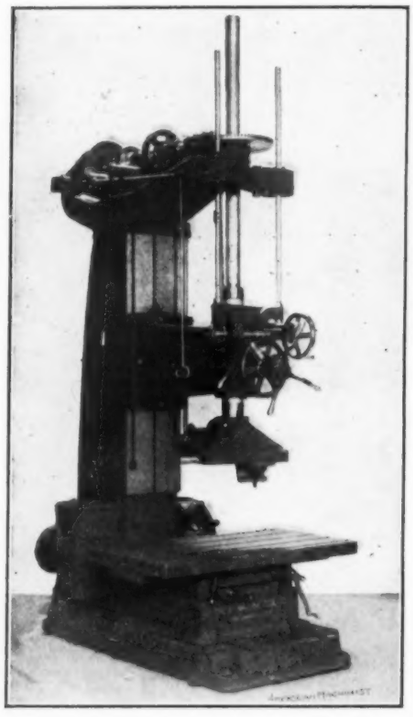
There doesn't seem to be any excuse for the local shop not being able to handle the work. Patternmaking is a very attractive trade and there ought to be a good living for the local shop if the men were skilled and kept strictly up to date.

It is unfortunately true that the John Jones, local man, might have more difficulty in getting his price for a good job than the Jones Pattern Works, a hundred miles away. But a fair price can be had if we are persistent and this whole thing ought to be a pointer for some live young patternmakers who know how to make patterns right or who will dig in and learn how, if they don't know already.

Shop Equipment News

Heavy Drilling and Boring Machine

This machine is designed for heavy drilling, tapping, cutting holes in steel plates, bars or connecting rods, and boring and facing such pieces. The driving mechanism is similar to an upright drill but is provided with a frictional starting, stopping and reversing device, operated by the bent handle, conveniently located at the left-hand side of the machine. The horizontal bar to which the fork and friction-clutch arrangement is attached is balanced and besides spring dowel pinned so it cannot engage by itself.



HEAVY DRILLING AND BORING MACHINE

The back gears are operated by steel clutches and the long vertical lever shown on the left-hand side engages or disengages them. There are two different kinds of feeds, the left-hand feed rod operates four different fine feeds for ordinary drilling and boring; but the right-hand feed rod provides for leads equal to the standard pipe threads. The nose of the spindle is provided with a facing head operated by a star feed.

The table is of the compound type, with longitudinal movement of 40 inches and a traverse movement of 8 inches.

The machine shown is motor driven, the speed changes are made by a five-step cone, and is a recent product of the Dreses Machine Tool Company, Cincinnati, Ohio.

ANY and all new or improved machines, tools or shop appliances of interest to men responsible for results in machinery-making plants will be briefly illustrated and described here — the machine shop news.
A more full and detailed description will be given — when it is real news — if it can appear here first — before it is sent to other papers. ALL descriptions appear in ALL four editions of the paper—Weekly, Monthly, Weekly English and Weekly German

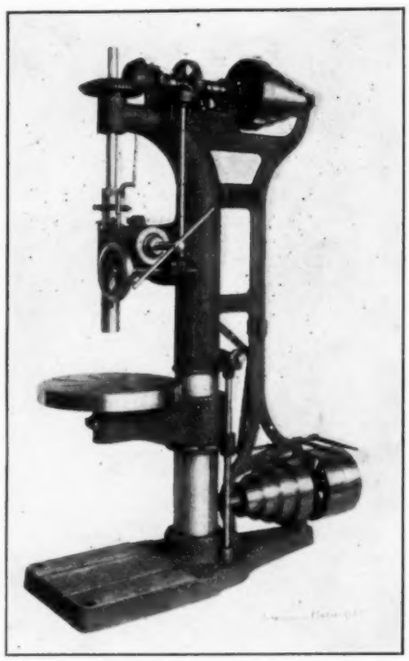
Adjustable Electric Light Bracket

The halftone shows the standard universal electric-light holder placed on the market by the Patterson Tool and Supply Company, Dayton, Ohio. With this bracket the operator on bench, work table or floor can adjust the bracket whereby the ray of light will be directed exactly on the spot where needed, and it is obviously applicable in all branches of manufacturing. These brackets are built for hard usage and are made of sheet steel, the joints operating on leather frictions between two disks and a strong rivet.

ADJUSTABLE ELECTRIC-LIGHT BRACKET

Stationary Head Drilling Machine

Solid design and simplicity are the features of this stationary-head drilling machine with geared feed, recently built by the Sibley Machine Tool Company, South Bend, Indiana.



STATIONARY HEAD DRILLING MACHINE

It will be noted that the feed mechanism derives its power from the top drive shaft, and all the gearing is completely inclosed and running in an oil bath. Four changes of feed and a neutral position are effected by moving a small knob in the center of the hand wheel. The automatic stop collar on the spindle sleeve trips a latch at the desired depth of hole and the worm swings away from the worm gear.

The machine is 6 feet 10½ inches high, its maximum between spindle and base is 42½ inches, has a table 21 inches in diameter, occupies a floor space of 55½ inches by 19½ inches, and weighs complete 1400 pounds.

Libby Turret Lathe

The accompanying halftone shows the latest model of turret lathe built by the International Machine Tool Company, Indianapolis, Ind. The machine is designed for rapid and accurate duplicate work, and is especially adapted for heavy chucking and bar work.

There is a wide range of spindle speeds and the feeds are all positive gear feeds. The feeds in each apron are entirely independent each of the other, both as to amount and direction, and are reversible. Hand feeds are possible on both carriages, one revolution of wheel moving the carriage one inch, and seven change gears are furnished.

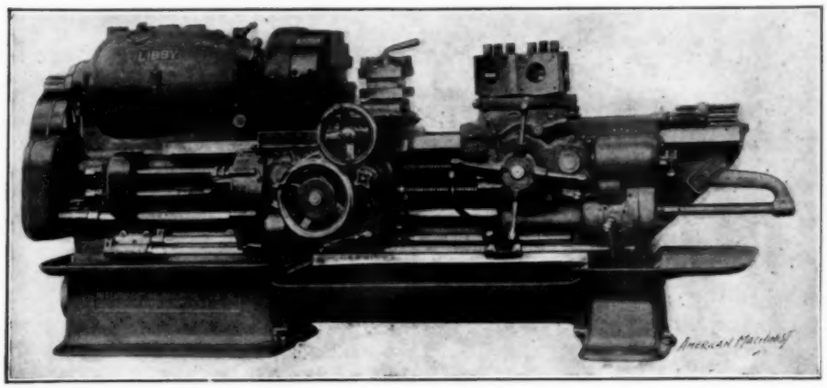
Automatic feed trip-offs are provided for each face of the turret and laterally for each face of the tool post. After these trip-offs have operated, there is an index pointer on a graduated scale to indicate the amount of cut taken, which is of convenience in forming work to an accurate depth and thickness. Any thread for ½-inch lead to as fine as desired can be cut, including 11½, while power rapid traverse is provided for each carriage. The traverse for each carriage is entirely independent of the other and can be operated either way, regardless of what the other carriage is doing or whether the feed is on or off.

The single belt-drive mechanism is separate from the headstock proper. It is fitted into a housing cast solid with the bed and headstock, so that the whole mechanism may be taken out, giving two speeds forward, which, together with the four mechanical changes in the headstock, gives eight speeds.

There are two double frictions in the headstock, one a band friction in the driving mechanism and one a cone friction in the intermediate shaft. The main chuck is 16 inches in diameter, and the tool post is of the four-sided heavy turret type. The rapid traverse laterally is independent, and will operate either way, regardless of whether the feeds are on or off.

The turret is of a hollow hexagon type, 12 inches in diameter, with six 3¼-inch holes. Each face of the turret is drilled to receive the various tools. The lock pin and clamp are operated by one lever. The turret has automatic stops for each face. The center of turret holes is 9 inches above the ways, and will permit a 10-inch die head to swing. It has power rapid traverse in carriage of 40 feet per minute, either way, and is provided with a sight indicator to advise operator of depth of cut should he want to use it after the stops have operated.

The machine swings over ways 18 inches, has a turret and carriage travel of 40 inches, and weighs complete 6000 pounds.

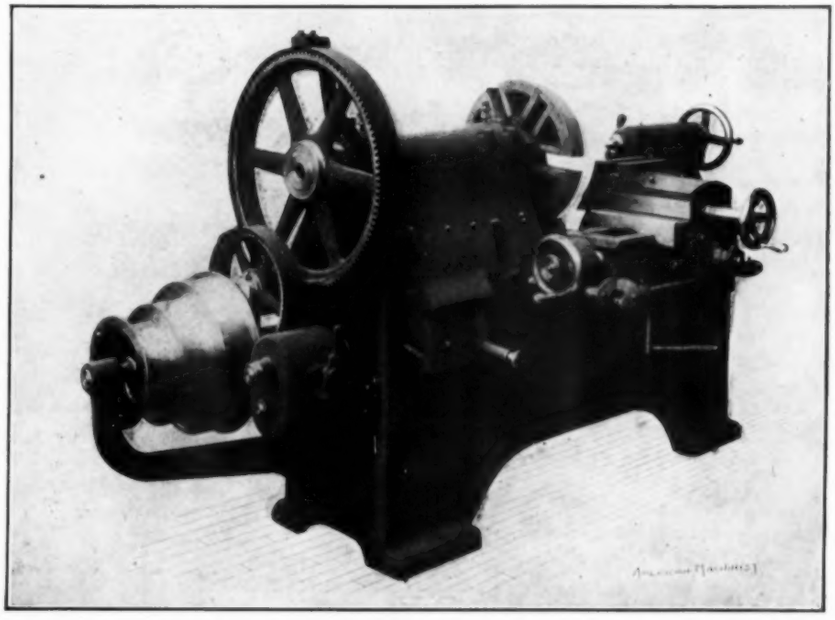


18-INCH LIBBY TURRET LATHE

Heavy Duty Pulley Lathe

This line of heavy-duty pulley lathes has been recently designed by the Cincinnati Pulley Machinery Company, Cincinnati, Ohio. The machine shown is provided with a three-step cone and two speed countershafts, running at 225 and 300, which gives six spindle speeds ranging from 7 to 30 revolutions per minute. The machine is geared from the cone-pulley shaft into a large intermediate gear, from there to another intermediate gear, which in turn meshes with a gear on clutch gear in gear box. By throwing lever in gear box to right, the clutch is engaged with clutch gear, which transmits the motion to tumbler shaft. This tumbler shaft carries four gears and by meshing these with the four gears on cone shaft, six feeds are obtained. By throwing lever in box to left, six more feeds are obtained, giving the 12 changes of feed ranging from 1/32 inch to ½ inch per revolution of spindle. Motion to worm shaft is obtained through bevel gear on cone shaft meshing with pinion on pinion shaft. Between the pinion shaft and the worm shaft on each side of the machine, universal joints are interposed to take care of the changes of position of the worm shaft when swiveling the table.

This machine is designed to turn gears, flywheels and pulleys up to 20 inches in diameter and 14-inch face, and can be furnished with either engine-lathe tailstock, as shown, or with swinging tailstock.



CINCINNATI HEAVY-DUTY PULLEY LATHE

Light High Speed Radial Drilling Machine

The machine shown herewith is designed especially to drive the drills that depend more on speed than feed for efficiency, ranging from ½ inch downward. In its field it can be driven at very high speed, and has the resultant economy in power consumed with the minimum of wear and tear.

The arm overhang is 30 inches, but the table, revolving on ball bearings, enables

the operator to many times reach a point 60 inches away from the column by merely revolving the table with the foot. The machine is driven with a 2-inch belt, and has power enough to drive drills up to 1⅛ inches. It has eight speeds and may be used to tap up to ½ inch. It is equipped with ball bearings throughout, including the swinging column, and both the column and table are equipped with locking screws so that they may be set in the position desired.

A new feature about the spindle drive is that it is driven from underneath the pulley instead of on top, which allows the use of a shorter and stiffer spindle, and the spindle pulley is inclosed by a bracket so as to eliminate, as far as possible, any belt strain, except a rotary one, from reaching the spindle. The equipment of the machine includes a counter-

LIGHT HIGH-SPEED RADIAL DRILL

shaft with a clutch and a subtable for the purpose of handling small parts.

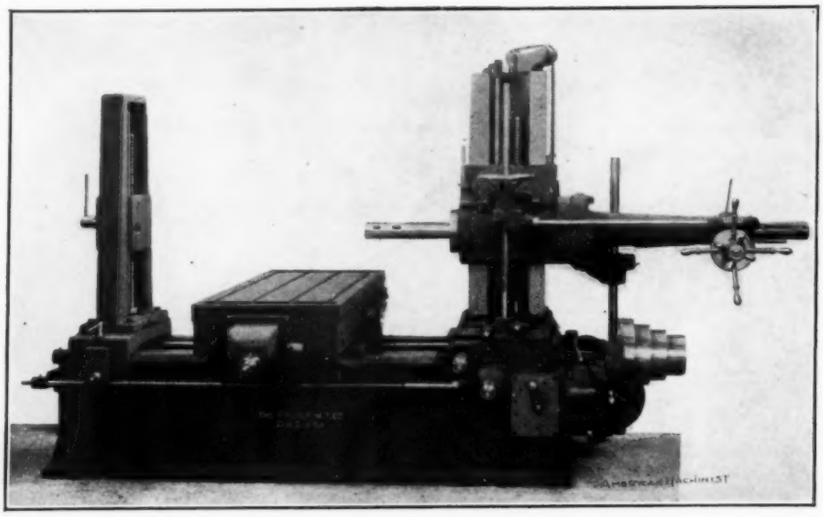
The machine is a recent product of the Henry & Wright Manufacturing Company, Hartford, Conn.

Horizontal Boring, Drilling and Milling Machine

The machine herewith illustrated represents a special horizontal boring, drilling and milling machine, built by the Fosdick Machine Tool Company, of Cincinnati, Ohio, to be used in a shop building sugar-mill machinery, where it will be subject to severe usage.

The machine is of interest because of the long table and table traverse. It is of the same type as the maker's regular line, but has the traverse of the table lengthened to 63 inches. The traverse of the column and outer support was lengthened to 27 inches.

The drop of the table at its maximum distance on the saddle on test was found to be only 0.002 inch, which is evidence of the rigidity of the saddle and bed.



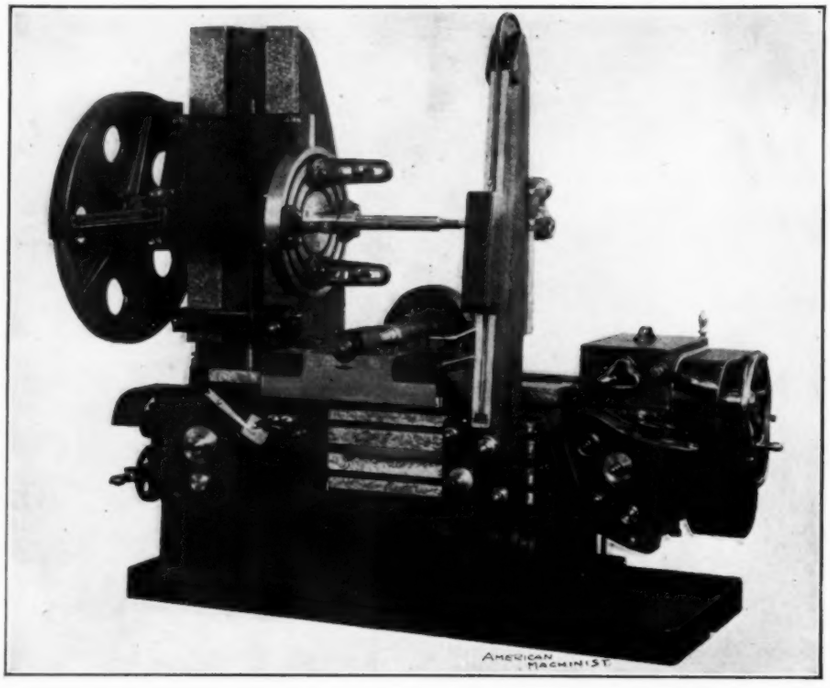
HORIZONTAL BORING, DRILLING AND MILLING MACHINE

Cincinnati Gear Cutter

In this machine the power is transmitted through one pulley, running at a constant speed, and the various speeds and feeds are obtained by transposing gears, conveniently located.

The work saddle is so gibbed to the housing that the work arbor and blank do not drop out of parallelism when the clamps are loosened, for adjusting the work for the tooth depth. The power elevating device for the work saddle is operated, up or down, by a single lever, and no gears are running when not in use. There is a hand adjustment and a micrometer collar, reading to 0.001 of an inch. The cutter slide has rectangular guiding surfaces with long taper gib for taking up wear. The length of the guiding surface is five times its width in order to reduce binding action. The slide is fed forward and retracted by a screw. There are two series of twelve feeds each, the extremes being ½ inch and 15½ inches per minute.

The cutter spindle is of large diameter and has six changes of speed. The drive is through a worm and wheel, with means for taking up end thrust wear of worm. The work spindle can be made to space once or revolve continuously by a hand movement. Index change gears are furnished to cut all teeth from 12 to 100



CINCINNATI GEAR CUTTER

and, with the exception of prime numbers and their multiples, frof 100 to 450.

The machine occupies a floor space of 101 inches by 53 inches and weighs complete 7740 pounds, and is manufactured by the Cincinnati Gear Cutting Machine Company, Cincinnati, Ohio.

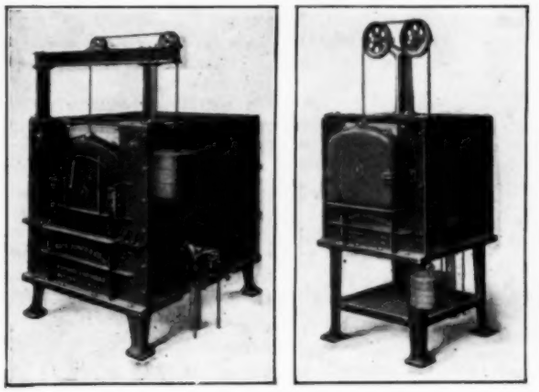
Heat Treating Furnaces

The accompanying halftones show three types of heat-treating furnaces recently perfected by Tate, Jones & Co., Pittsburg, Penn.

The first is a pack-hardening, case-hardening and annealing furnace, using oil or gas, designed for a class of work larger and in greater quantities than can be economically handled in the commonly used smaller sized furnaces. This furnace is particularly adapted for work requiring and maintaining high temperatures, and for annealing long bars without packing, as well as automobile parts, both packed and unpacked.

The second illustration shows a semi-muffle furnace, particularly designed for hardening and annealing high-speed and carbon steel, cutters, dies, etc.

The third furnace shown is a tempering bath, used with oil or gas fuel, and can be equipped with bath pots in shapes and sizes to meet varying requirements. The bath is equipped with a thermometer as shown.



CASE-HARDENING, TOOL-HARDENING AND TEMPERING FURNACES

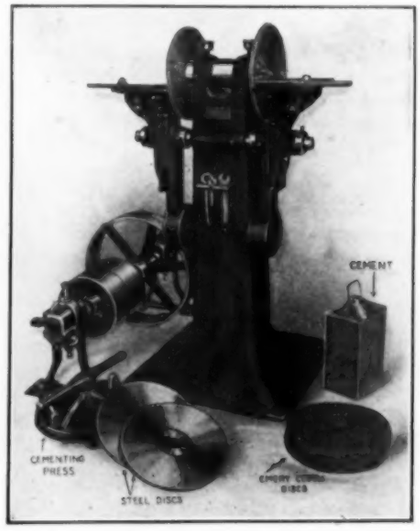
Double End Disk Grinder

The accompanying halftone illustrates a new 10-inch ball bearing disk grinder, double-end type, brought out by the Rowbottom Machine Company, Waterville, Conn.

The spindle is mounted in ball bearings of the Hess-Bright make, which are dust-proof and constantly supplied with lubricating grease. The tables have a rocking motion across the face of disk, or can be fastened in a fixed position. They are also provided with vertical adjustment, angular adjustment to the face of the disk, and with an adjustable gage for any angle, or square position on the horizontal plane.

The construction of the spindle and bearings is such that one ball race is closely fitted in the head of column; the other is allowed clearance at each side, permitting it to slide endwise when subjected to changes in temperature, thus avoiding all danger of the ball races crowding, or binding each other, and eliminating the possibility of damage to bearings, or increased friction in machine. All end thrust in either direction is taken by the same bearing, and the ball races can readily be changed to opposite ends of the spindle.

The machine weighs 800 pounds, diameter of disks 12 inches, running at 2500 revolutions per minute, and has a vertical adjustment of 4 inches.



DOUBLE-END DISK GRINDER

Increasing Shop Capacities

METAL WORKING

NEW ENGLAND

J. E. Hoglund, of Gardner, Mass., will build a new foundry.

The Howe Scale Company, Rutland, Vt., will erect a new $40,000 foundry.

Plans are being drawn for an addition to the factory of the Clinton Wire Cloth Company, Clinton, Mass.

The K. Manufacturing Company, making jewelry, Providence, R. I., is to erect a plant on Prairie avenue, that city, into which it will move when completed.

Charles H. Metz, head of the Waltham (Mass.) Manufacturing Company, has purchased site on which a plant for building aëroplanes will be erected.

MIDDLE STATES

The Buffalo (N. Y.) Machine Company will erect a three-story addition.

The Standard Oil Company will install a new foundry at Cleveland, O.

News items for the sales department — where more equipment will be needed. Authentic news is solicited for this department, not rumors or gossip — facts

The Bashline Tool Works, Grove City, Penn., is erecting a two-story addition.

The Johnston Harvester Company, Batavia, N. Y., will erect two additional buildings.

Sly Manufacturing Company, Cleveland, O., foundry appliances, will erect a new factory.

The General Electric Company is to erect another building at its plant in Erie, Penn.

The Park Drop Forge Company, of Cleveland, Ohio, will erect an addition to its plant.

The Union Spring and Manufacturing Company, New Kensington, Penn., will enlarge its plant.

Moon Brothers, Grove City, Penn., are erecting an addition to their garage and machine shop.

A permit has been issued to O. C. Ringle, 1449 West Eighty-first street, Cleveland, Ohio, for a garage.

Equipment is being purchased for the new plant of the Victor Safe and Lock Company, Cincinnati, Ohio.

A permit has been issued to Crompton & Knowles, Philadelphia, Penn., for the erection of a garage.

The Aluminum Goods Manufacturing Company, Manitowoc, Wis., is completing plans for a new plant.

R. B. Dunkle, Reading, Penn., has taken out a permit for a garage in the rear of 541 Schuylkill avenue.

The Winton Motor Carriage Company, Cleveland, Ohio, is having a large addition built to its plant.

The T. B. Laycock Manufacturing Company, Indianapolis, Ind., is in the market for riveting machinery.

The Allegheny Steel Company has let contract for addition to its plate mill at Brackenridge, Penn.

Fire damaged the plant of James Barker & Co., iron founders, Sixth and Congress streets, Philadelphia, Penn.

A permit has been issued to D. J. Potter, Philadelphia, Penn., for the erection of two garages at 4664-66 Wyoming avenue.

The Quinlan Boiler Company, Indianapolis, Ind., which has just completed a new boiler shop, will shortly add a machine shop.

The Portland (Mich.) Manufacturing Company, making washing machines, is erecting an addition to be used as a brass foundry.

Plans have been prepared for a new five-story shop for the American Can Company, at Beach and Palmer streets, Philadelphia, Penn.

The National Machine Company, engineers and machinists, Milwaukee, Wis., are having plans prepared for a two-story machine shop.

The Advance Machine Company, 525 Hamilton street, Toledo, Ohio, has taken out a permit to erect an addition to its present plant.

The Toledo (Ohio) Computing Scales Company has taken out building permit for the erection of an addition to its plant on Dorr street.

The J. A. Fay & Egan Company, Cincinnati, Ohio, manufacturing woodworking machinery, has secured site for a new plant at Bond Hill.

The Le Grand Bronze Company, Plainfield, N. J., has purchased land at Bayonne, N. J., and will erect a plant for the manufacture of bronze bushings.

The Cleveland Aluminum Casting Company, Cleveland, Ohio, has been incorporated by Fred F. Klingman, M. J. Hancox, R. S. Hoffman, etc. Capital, $10,000.

The plant of the Lincoln Stove Range Company, of Fremont, Ohio, has been bought by Mozart Gallup, of Sandusky, Ohio, and others, and will operate same.

Plans have been finished for a two-story automobile sales building and garage, at 660 to 666 North Broad street, Philadelphia, Penn., for Samuel Sternberger.

The automobile parts factory, owned by Thomas Warner, at Muncie, Ind., is to be enlarged. Mr. Warner is now erecting a similar factory at Toledo, Ohio.

S. Sternau & Co., manufacturers of alcohol lamps, etc., has awarded contract for the erection of a 10-story factory building on Plymouth, near Gold street, Brooklyn, N. Y.

The Canners Can Company, Chicago, Ill., has purchased site at Western avenue and West Forty-ninth street and is said to be planning the erection of a new plant to cost $250,000.

The Cincinnati (Ohio) Steel Castings Company, now located on Kenyon avenue, will build a new plant on Queen avenue, near Springgrove avenue, which will be three stories high.

The Foxworthy Electric Company, Indianapolis, Ind., has been incorporated to manufacture electrial supplies. Capital, $10,000. Incorporators, M. K. and E. H. Foxworthy, L. R. Miller.

The Consolidated Automobile Company, Anderson, Ind., has been incorporated to manufacture automobiles. Capital, $50,000. Incorporators, Henry Nyberg, Harry Hamilton, P. H. Doyle.

The Theodore Niehous Company, Cincinnati, Ohio, has been incorporated with $25,000 capital to manufacture jewelry. Incorporators, Theodore Niehous, Chas. Theye, Silas B. Waters, etc.

The Cleveland Auto Spring Company, Cleveland, Ohio, has been incorporated for $15,000 to manufacture auto springs. Incorporators, H. F. Ehlet, J. A. Flajole, W. J. Patterson and B. M. Baner.

The Consolidated Automobile Company, Anderson, Ind., has been incorporated with a capital of $50,000 by Henry Nyberg, Harry Hamilton and P. H. Doyle, to do a manufacturing business.

The Clark Motor Company, building electric pleasure cars and motor trucks, will locate in Buffalo, N. Y. Has secured temporary quarters at 1738 Elmwood avenue. Will erect a plant later.

The Mansfield Specialty and Machine Company, Mansfield, Ohio, has been organized to operate a machine shop and manufacture machinery by Oscar Krebs. Heinrich Beltstein, Carl Beltstein, etc.

The United States Brass Company, Upper Sandusky, Ohio, has been incorporated with $25,000 capital to manufacture brass articles. Incorporators, W. P. Howland, W. A. Gipson, C. A. McBeek, etc.

The Dayton Engineering Laboratories Company, of Dayton, Ohio, will begin manufacturing ignition apparatus and special automobile parts. Its plant at Chicago, Ill., will be moved to Dayton, Ohio.

The Mason Engineering and Manufacturing Company has been incorporated at Sharon, Penn., and will erect a plant at West Middlesex for the manufacture of water heaters. Frank Lodge, of Sharon, is president.

The National Fabric-Cutting Machine Company, Newark, N. J., has been incorporated to manufacture fabric-cutting machinery. Capital, $100,000. Incorporators, Geo. M. Lamb, Emanuel Pignone, Edmund R. Holer.

W. A. Gipson, of Upper Sandusky, Ohio, is organizing a company for the purpose of buying the plant and stock of the Perfect Bib and Faucet Company, which is now in the hands of Receiver William W. Vieth.

The Krause Konstant Carburetor Company, Cleveland, Ohio, has been incorporated for $15,000 to manufacture carburetors. Incorporators, R. E. Krause, Edward Younger, F. G. Castle, F. E. Pheiffer and W. K. Caldwell.

The Maumee Foundry Company, Woodville street, Toledo, Ohio, which has been closed for some years, will again be put in operation with P. H. Lavin, manager, who was at the head of the concern before it gave up operation.

The Cincinnati Machine Tool Company, Cincinnati, Ohio, has been incorporated to manufacture and sell machinery and tools by R. E. Carl, W. W. Bellow, F. W. Wood, Rudolph Kernan, John J. Hickey. Capital, $20,000.

The Jackson Park Garage and Machine Company, Chicago, Ill., has been incorporated to do an automobile and garage business. Capital, $15,000. Incorporators, John V. Newstrom, C. Edgar Jernberg, C. Richard Jernberg.

SOUTHERN STATES

The Union Pacific Railroad will erect a $50,000 roundhouse at Fort Collins, Colo.

The B. J. Robinson Machine Works, Vicksburg, Miss., will erect an iron foundry and garage.

The Case Threshing Machine Company is erecting a new plant at Eleventh street and Broadway, Louisville, Ky.

The Phoenix Motor Car and Truck Company, Brooklyn, N. Y., has been incorporated with $100,000 to manufacture motor vehicles, etc. Incorporators, F. W. Helman, H. A. Bedell, H. P. Helman.

The Thermal Motor Company, Camden, N. J., has been incorporated to manufacture motors for driving fans, vacuum cleaners, etc. Capital, $100,000. Incorporators, A. P. Nichols, C. J. Rogers, F. Scheff, Philadelphia.

The Baltimore Gas Appliance and Manufacturing Company, Hamburg and Bayard streets, Baltimore, Md., is preparing to install equipment to include machinery for foundry, sheet-iron work, pattern shop, pipe cutting, etc.

The Vesta Gas Range and Manufacturing Company, Chattanooga, Tenn., has been incorporated to manufacture stoves, ranges, etc. Capital, $100,000. Incorporators, M. H. Coffey, Theodore Ringwald, J. A. Hill, of Chattanooga.

The Eastern Parkway Automobile Company, New York, has been organized. Capital, $100,000. Incorporators, Harry Meisner, 1839 Prospect place; Charles Palash, 435 Rockaway avenue, Brooklyn, etc. Will manufacture motors, engines, motor vehicles, etc.

The Piedmont Traction Company, and Greenville, Spartanburg & Anderson Railway, which is to construct an electric railway from Charlotte, N. C., to Greenville, S. C., will locate its main shops near Charlotte and auxiliary shops at Greenville. J. B. Duke, of New York is present; W. S. Lee, of Charlotte, vice-president.

WEST OF THE MISSISSIPPI

The Martin Machinery Company, Joplin, Mo., will erect a machine shop.

W. A. Moore, Anacortes, Wash., is planning to open a new sheet metal-works establishment.

The plant of the Carson-Lusk Hardware Company, Boise, Idaho, was destroyed by fire. Loss, $125,000.

E. T. Krause, Seventh avenue, San Francisco, Cal., has taken out a permit to build a new blacksmith shop.

James Betchel, Chino, Cal., will build a commercial garage and repair shop. Modern equipment will be installed.

The Rulofson Metal Window Works, San Francisco, Cal., has taken out a permit to build an addition to its factory.

Adam Tettelbach, East Twenty-ninth street, Los Angeles, Cal., has taken out a permit to build a new sheet-metal working plant.

W. D. Allen, Seattle, Wash., has had plans prepared for a new commercial garage and repair shop. Modern equipment will be installed.

The Riverside Steel Foundry Company, Riverside, Cal., now planning to build a foundry, will later in 1911 erect a large machine shop.

The Electric Properties Company, Great Falls, Mont., will build new car barns and shops. E. I. Holland is manager of this corporation.

The Oklahoma Railway Company contemplates the erection of repair shops and car barns on Western avenue and Third streets, Oklahoma City.

The Santa Fe Railroad is planning to build a 50-engine roundhouse and large machine shops at Fresno, Cal. W. L. Bradley, engineer, Fresno.

The Standard Brazing Works, Los Angeles, Cal., has leased quarters on South Los Angeles street, Los Angeles, Cal., and will establish a new plant.

The T. S. Steel Machine Company, Walla Walla, Wash., is planning to build a new machine shop to be used principally for automobile and repair work.

The Bricker Motor Car Company, Los Angeles, Cal., has leased new quarters and will establish a new garage. A machine and repair department will be installed.

The Myers Pump and Manufacturing Company, St. Joseph, Mo., incorporated with $60,000 capital, will establish a plant for the manufacture of pumps, engines, etc.

The Acme Hoisting Machine Company, St. Louis, Mo., has been incorporated with $50,000 capital to manufacture and deal in hoisting and carrying machinery. Incorporators, Frank R. McCune, Geo. S. Cornell, John M. Patke.

The Scott Gasolene Rock Drill Company, St. Louis, Mo., has been incorporated with $500,000 capital to manufacture a gasolene rock drill invented by Louis L. Scott. Incorporators are Louis L. Scott, John R. Williams, S. D. Martin, etc.

The Pacific Corrugated Pipe Company, Los Angeles, Cal., recently incorporated, has purchased the plant of the Doak Sheet Steel Company, in that city. The plant will be improved and new machinery will be installed for the manufacture of corrugated iron pipe.

The Los Angeles Brass Manufacturing Company, Los Angeles, Cal., has been organized with a capital of $25,000 to take over the plants of the L. A. Brass Works and Liebfried Brass Manufacturing Company. These establishments will be merged and generally improved; new machinery will be installed.

CANADA

The Western Bridge and Equipment Company will build a new factory at Chatham, Ont.

The Ontario Wind Engine and Pump Company is building a large new factory at Winnipeg.

The Canadian Pacific will equip a new car-repair shop at Moosejaw, Sask., with the latest machinery.

The J. Watterson Company, manufacturer of iron and other products, will locate a big factory in Montreal.

The Grand Trunk will make important extensions to its roundhouse and big machine shops at Ottawa, East.

The Canadian Pacific Railway will double its passenger-car shops at Winnipeg, and will install a large quantity of new machinery.

McFarlane & Douglas are building a large new factory at Ottawa for the manufacture of fireproof steel doors and office equipment.

The British-Canadian Shipbuilding and Dock Company has been incorporated with $10,000,000 capital for establishing a shipbuilding plant on Sydney Harbor, Nova Scotia. Incorporators, A. C. Ross, of Sydney, N. S.; Governor J. M. Gibson, of Ontario; Sir Henry Pellatt, of Toronto, etc.

General Manufacturing

NEW ENGLAND

Wellesley, Mass., will install a new sewer system.

Rockland, Mass., contemplates the purchase of a stone crusher.

Taunton, Mass., will spend $15,000 improving its sewer system.

The Esmond Mills, Esmond, R. I., will install a steam turbine.

Manchester, Mass., will improve and extend its sewer system.

Holyoke, Mass., will spend $75,000 on improving its water system.

The Pilgrim Mills, Fall River, Mass., will erect a $1,000,000 cotton factory.

Weare, N. H., will build a new reservoir; pumps and engine will be needed.

The Celluloid Starch Company, New Haven, Conn., will erect a three-story building.

G. C. Bachelier & Co., Bridgeport, Conn., are planning to erect a new power plant.

The Bigelow Carpet Company, of Lowell, Mass., will erect a three-story addition.

The Morley Button Company, Portsmouth, N. H., will build an addition to its factory.

The Yale & Towne Company, Stamford, Conn., will make additions to its power plant.

The American Writing Paper Company will install a new power plant at Holyoke, Mass.

The Salts Textile Company, of East Bridgeport, Conn., will build an addition to its mill.

The town of Franklin, Mass., is to expend $50,000 for improvements to its water system.

The Pepperell Cotton Company, Biddeford, Me., is to erect a weave shed of 4½ acres.

The Goetz Silk Manufacturing Company, Holyoke, Mass., will erect a three-story factory.

Rice & Hutchins Company will build an addition to its shoe factory at Rockland, Mass.

A new heating system and power plant will be built at the navy yard, Portsmouth, N. H.

Fire destroyed the plant of the Columbian Canning Company, Lubec, Me. Loss about $35,000.

The United States Worsted Company, of Lawrence, Mass., will add another mill to its plant.

The National Fibreboard Company, Leominster, Mass., is removing its plant to Bar Mills, Me.

Plans are being drawn by the Plymouth Rubber Company for a new factory at Canton, Mass.

The American Hosiery Company, New Britain, Conn., is to build an addition to its present factory.

The Howell Pearl Button Company has just completed the erection of a new plant at Waltham, Mass.

The Norton Company, manufacturing grinding wheels, Worcester, Mass., will erect a four-story addition.

Aldrich Brothers, cotton and silk-cloth manufacturers, Moosup, Conn., will erect an addition to their plant.

The Central Falls Stone Company, Central Falls, R. I., is in the market for concrete block machinery.

The Massachusetts Mohair Plush Company, Lowell, Mass., expects to build a large addition to its factory.

The Textile Finishing Machinery Company, Plant B, Providence, R. I., will install a central power plant.

The Bay State Belting Company, Boston, Mass., is taking bids on construction of a new factory at Salem, Mass.

The Peabody Electric Light Works, Peabody, Mass., are expecting to install new boilers to the extent of about 1000 horsepower.

Leonard C. Midgely, Worcester, Mass., is to have two large greenhouses constructed for which two 100-horsepower boilers will be required.

G. C. Batcheller & Co., corset manufacturers, Bridgeport, Conn., will add to their West End plant a one-story structure for a power plant.

The business of the Acme Pearl Company, Providence, R. I., has been purchased by J. Bloom & Co., Attleboro, Mass., and will be removed to that place.

MIDDLE STATES

Fred Hartman, Evansville, Ind., will build a bakery to cost $30,000.

General Lithograph Company, Columbus, O., will enlarge its plant.

The plant of the Ohio Brush Company, Cleveland, O., was burned.

Power plant will be required for the new City Hall building, Cleveland, O.

The Muldoon Underwear Company, Mohawk, N. Y., is enlarging its plant.

The Columbus Bolt Works, Columbus, Ohio, is in the market for pressure blowers.

A. T. Montgomery, Moro, Ill., will erect a small concrete tile plant at that point.

The Otis Lithographing Company, Cleveland, O., will build a large plant at once.

The Wearwell Rubber Company, Marion, Ind., will move its plant to Kokomo, Ind.

The village of Logan, Ohio, is preparing plans for the construction of a waterworks.

The Springfield Pure Milk Company, of Springfield, Ohio, will erect a large factory.

The Cleveland (Ohio) Electric Illuminating Company is now erecting its $2,500,000 new plant.

The Patten Manufacturing Company, Chattanooga, Tenn., is in the market for an air compressor.

The Frontier Elevator and Milling Company, Buffalo, N. Y., will erect a $20,000 elevator tower.

The plant of the Ohio Valley Furniture Company, Gallipolis, O., was destroyed by fire. Loss $100,00.

The Standard Bar Fixture Company, Cleveland, Ohio, is having a four-story addition built to its factory.

Fire did $25,000 damage to the paper-box plant of Owens & Traeger, 1101-5 Jefferson street, Hoboken, N. J.

The Samaritan Hospital, Philadelphia, Penn., will install a new heating and lighting plant this summer.

The Evansville Woolen Mills Company, Evansville, Ind., has issued $100,000 in bonds and will enlarge its plant.

Joseph Collier & Co., manufacturing carriage and automobile bodies, Newark, N. J., will erect a five-story factory.

J. W. Bales, of Fithian, Ill., has acquired property and will erect a factory for the manufacture of cement blocks.

The plant of the *Toledo Blade*, a newspaper of Toledo, Ohio, has been damaged by fire to the extent of $125,000.

The Blum Shoe Company is rebuilding its plant at Danville, N. Y., which was burned recently with a loss of about $75,000.

The Cleveland Light and Power Company, Cleveland, O., has increased its capital from $100,000 to $250,000. Will add equipment.

Fire destroyed more than $10,000 worth of oil and tank property at the plant of the Paragon Refining Company, Cleveland, Ohio.

The Von Behren Manufacturing Company, Evansville, Ind., manufacturer of spokes and hubs, will build a new addition to its plant.

The Wolflin-Luhring Lumber Company, Evansville, Ind., will erect a planing mill in its yards, work on the plant to start at once.

A. R. Mosier & Co., manufacturers of automobile specialties, of New York, will erect a factory in Wakefield Park, Yonkers, N. Y.

The Brooks Candy Company, Grand Rapids, Mich., will build a two-story addition to its plant on South Ionia street; also a power plant.

The Caswell-Runyan Company, Huntington, Ind., whose chief output is cedar chests and shirtwaist boxes, will double the size of its plant.

The Class & Nachod Brewing Company, Philadelphia, Penn., will make alterations in its power plant. Oil engines will be installed.

The Federal Glass Company, of Columbus, Ohio, has awarded a contract for the erection of a large addition to its plant in South Columbus.

The Moerlein Brewing Company, of Cincinnati, Ohio, has been granted a permit to erect a $75,000 brick and concrete bottling plant on Elm street.

An eight-story factory will be erected for Thomas & Co., manufacturing children's shoes, on Willoughby, near Sanford street, Brooklyn, N. Y.

The Hess & Goldsmith Company, of Wilkes-Barre, Penn., silk manufacturer, intends to erect a three-story addition to its west side (Kingston) plant.

The Jamestown (N. Y.) Street Railway Company has commenced work on a large addition to its central power station on West Eightieth street.

The Cleveland & Pittsburg Coal Company is planning improvements to cost $100,000, including a large unloading plant on Lakeside avenue, Cleveland.

City of Cleveland (O.) is to have a new large market house for which power and refrigeration plant will be required. Goaks & Dettlebauck, promoters.

A five-story and basement factory is to be built for the David Weber Company, manufacturing paper boxes, at Fifth and Locust streets, Philadelphia, Penn.

The Lockland Brick Company, Lockland, Ohio, has been formed to manufacture brick by Joseph E. Smith, John B. Obert, F. D. Reiley, etc. Capital, $20,000.

Messrs. Alex. Richter and H. E. Ball, of Charleston, Ill., propose to organize a company for the purpose of erecting and operating a flour mill at that point.

Work will soon commence on the new plant of the Pennsylvania Salt Manufacturing Company, E. Shelly street, west of Seventh street, Philadelphia, Penn.

Fire did about $22,000 damage to the Embury Manufacturing Company's plant, State and Platt streets, Rochester, N. Y. The concern manufactures lanterns.

The Western Manufacturing Company, Toledo, Ohio, manufacturing sash, doors, etc., will erect an addition to its plant at Water and Walnut streets, to cost $10,000.

The Saxon China Company, Sebring, Ohio, has been organized to manufacture and sell china ware by Fred E. Sebring, Kate D. Sebring, Mary Sebring. Capital, $350,000.

A new interuban railway, called the Akron, Canton & Youngstown Railroad, is being surveyed. May desire some power or other equipment. Present office at Akron, Ohio.

The Village Board of Fredonia, N. Y., has authorized its engineer, Mr. Wilder, to prepare plans and estimates for elaborate improvements to the village waterworks system.

The United States Match Company, Elkhart, Ind., has been incorporated with a capital of $165,000 by W. W. Sterling, P. F. Langacher and R. W. Meguire to manufacture matches.

The Capital Plating Company, Indianapolis, Ind., has been incorporated with a capital of $20,000 by C. H. Barger, E. B. Fletcher and J. T. Harris, to do a general plating and polishing business.

At Port Clinton, Ohio, the Wolfgram Marble Company, recently incorporated with a capital of $300,000, will build a large plant east of the city for the manufacture of cement products.

The New Newburg Canning Company, Newburg, Ind., has been incorporated with a capital of $10,000 by J. E. Ashbier, C. J. Ashbier, Walter and T. R. Queene, to do a canning business.

The Enterprise Granite Company, Warren, Ohio, has been organized with $25,000 capital to quarry and sell granite, marble and other stone, by J. W. Love, W. E. Dieley, R. C. Lathrop, etc.

A power plant will be established to supply light and power for the several buildings that the National Electric Lamp Company will erect at Cleveland, Ohio. About $250,000 will be expended.

The Pittsburg Envelope Company, Pittsburg, Penn., has been organized with $200,000 capital to manufacture envelopes, etc. Incorporators, E. M. Develing, E. J. Bossinger, F. L. Cleveland.

Electrical equipment will be required for the seven-story addition that will be built to the Colonial Hotel, at Cleveland, Ohio. Estimated cost, $200,000. Engineer F. C. Warner has completed plans.

W. H. Glover, of Sebring, Ohio, has organized a company and will locate a clay-working plant in Terre Haute, Ind., for the manufacture of porcelains, incandescents and a general line of pottery ware.

The Citizens Heat and Light Company's plant, at Elwood, Ind., has been sold to the Bacon-Olds Company, of Indianapolis, Ind. The new company will begin the construction of an artificial gas plant at once.

The Euclid Doan Power Company, Cleveland, Ohio, has been incorporated to manufacture and sell electrical current. Incorporators, Samuel H. Silbert, Joseph Morgenstern, Sidney S. Harvey, etc. Capital, $50,000.

The Sun Manufacturing Company, of Columbus, Ohio, has increased its capital stock from $125,000 to $187,500. It is proposed to enlarge the capacity of the plant. The company manufactures showcases, coffee mills, etc.

The American Zinc, Lead and Smelting Company, which is controlled by the United States Smelting, Refining and Mining Company, now operating smelters at Caney and Dearing, Kan., has acquired land at Hillsboro, Ill., and will erect a million-dollar smelting plant at that point.

The Mudlick Distilling Company, of which M. Markstein, of Cincinnati, will be president, and M. Durner, of Cincinnati, vice-president, has been organized in Cincinnati, to take over the Germantown, Ohio, distillery. This plant has been closed since 1907, but will now be put into running order and operated to its full capacity.

SOUTHERN STATES

The Louisville (Ky.) Cotton Oil Company will erect a one-story power plant.

Henry Roesser & Sons, 338 South Fremont avenue, Baltimore, Md., have awarded contract for the erection of a three-story addition to their furniture factory.

Contract has been let for the construction of the Duneau Cotton Mills at Greenville, S. C. This is a million-dollar concern organized by Capt. Ellison A. Smith. Offices are in the Masonic Temple, Greenville.

WEST OF THE MISSISSIPPI

The city of Alturas, Cal., will install a new sewer system.

T. H. Stevens, Alice, Tex., will construct a 10-ton ice plant.

The city of Concord, Cal., is asking for bids for a new sewer system.

The Union Ice Company, Colusa, Cal., will build a large cold-storage house.

John Frank, Sandpoint, Idaho, will build a new grain elevator and milling plant.

The Hobson Brothers Packing Company, Ventura, Cal., will install a new refrigerating plant.

The California Portland Cement Company, Colton, Cal., will double the capacity of its plant.

The Kilmer & Kinzie Sawmill Company, Oregon City, Ore., is planning to build a new sawmill.

Wymore, Neb., is asking bids for the construction of a combination power plant and city hall.

The Grants Pass (Ore.) Gas Company is having plans prepared for a new gas plant in this city.

The Union Ice and Cold Storage Company, Salt Lake City, Utah, will build an addition to its plant.

The Valley Development Company, Portland, Ore., will build a large power plant on the Cowlitz river.

The Andrews Light and Power Company, Salmon City, Idaho, will install a new generating equipment.

The Mica (Wash.) Brick and Tile factory will increase the capacity of its plant. Plans are being prepared.

The city of Perry, near Brigham City, Utah, is contemplating the installation of a waterworks system.

A. Beilstein, Toppenish, Wash., will build a new ice and cold-storage plant. About $20,000 will be expended.

The Merchants' Light and Power Company, Ogden, Utah, is planning to build a power plant to serve this section.

Power-plant equipment will be required in the new 10-story building contemplated by R. M. Gray, Portland, Ore.

The Pacific Gas and Electric Company, Oakland, Cal., has taken out a permit to build an addition to its plant.

The Glazed Pipe and Tile Company, Boise, Idaho, is planning to build a new manufacturing plant at Weiser, Idaho.

The Schade Brewing Company, Spokane, Wash., is planning to erect a new cold-storage plant. Estimated cost, $20,000.

The Producers' Fruit Company, Lodi, Cal., is planning to build a new plant, replacing that recently destroyed by fire.

Sixty-thousand dollars bonds have been voted at South Jacksonville, Fla., for building a water, light and sewage system.

Leopold D. Caminetti, Jackson, Cal., has filed a water right in this district and is planning to build a power plant.

The Modesto Gas Company, Modesto, Cal., is planning to make extensive improvements and increase the capacity of its plant.

E. W. Rumble, Elgin, Ore., is planning to build a power plant on the Wallowa river. A power franchise has been asked at Elgin.

The State Geological Board, Olympia, Wash., is planning to install an irrigation system on 300,000 acres in Quincy Valley.

The Spokane Gas Company, Spokane, Wash., is planning to increase the capacity of its gas plant. About $100,000 will be expended.

The Western State Gas and Electric Company, Lodi, Cal., has purchased property and will build a new substation and transformer house.

The Corona Electric Light Company, Corona, Cal., is planning to make extensive improvements in its plant and distributing system.

The Crown Laundry and Cleaning Company, Los Angeles, Cal., is having plans prepared for a new factory. Modern equipment will be installed.

The Twin City Light and Traction Company, Centralia, Wash., is planning to build a power plant at Chehalis. About $75,000 will be expended.

J. F. Megginson, La Sierra Heights, near Arlington (Riverside), Cal., is contemplating the installation of a large pumping plant on property in this section.

The Sacramento Electric, Gas and Railway Company, Sacramento, Cal., is planning to make improvements and additions in the near future to cost $1,500,000.

J. C. Morgan, Boise, Idaho, is planning to build a new canning factory. About $50,000 will be expended. The Commercial Club of this city is interested.

The Excelsior Cereal Milling Company, Los Angeles, Cal., has purchased property adjoining its factory and will build an addition. New equipment will be installed.

The Western Water Company (C. B. Colby), Bakersfield, Cal., is planning to establish pumping plants at Taft and Rio Bravo. Large pumping apparatus will be required.

Power-plant equipment will be required for the new store and office building to be erected at San Francisco, Cal., by R. Huddleston. Wm. Curlett & Son, architects, San Francisco.

The Pacific Gas and Electric Company, Phœnix, Ariz., has issued bonds for $1,250,000. The company is planning for extensive improvements and additions in its properties.

Power-plant equipment will be required in the new municipal building to be erected at Oakland, Cal. Estimated cost, $1,000,000. Palmer & Hornbostel, architects, New York city.

The Fir Tree Lumber Company, Tacoma, Wash., will build a new sawmill near Rainier, Wash. About $75,000 will be expended. G. B. Richardson, Tacoma, is head of this company.

The Oregon Power Company, Eugene, Ore., has purchased the plant of the Brownsville Electric Light Company, Brownsville, Ore. The plant will be improved and the system rebuilt.

The city of San Francisco, Cal., will expend $36,000 on a waterworks development system in the Cherry creek district in 1911. City Engineer Mason is in charge of the project.

Power-plant equipment will be required in the seven-story building to be erected at Spokane, Wash., by the Crescent store. About $200,000 will be expended. L. L. Rand, architect, Spokane.

The People's Power Company, Willows, Cal., is planning to build an electric railway system from Woodland to Redding. The company will soon be in the market for complete equipment for this work.

The John Breuner Company, Sacramento, Cal., operating a large furniture factory, is contemplating the removal of its plant to the Haggin Grant district. The capacity of the plant will be increased.

The Ramona Power Company (J. H. Grigsby, Santa Monica, Cal., president), is planning to build a series of three power plants in the San Jacinto mountains. A. H. Koebig, engineer, Los Angeles, Cal.

Power-plant equipment will be required in the new hotel to be erected at Klamath Falls, Ore., by the Klamath Falls Development Company. Estimated cost, $125,000. B. G. McDougall, architect, San Francisco, Cal.

The rock-crushing plant of the Star Sand Company, Portland, Ore., at St. Helens, was completely destroyed by a dynamite explosion. Machinery to the extent of $20,000 was destroyed. C. Mensinger is manager of this company.

The committee of supervisors, San Francisco, Cal., is arranging for a site for the new power house to be erected in connection with the Geary Street municipal railway. The plant will be fully equipped. Plans will soon be prepared.

The Northwest Table Manufacturing Company, Tacoma, Wash., has been organized with a capital stock of $300,000. The plant of the Tacoma Table Company has been purchased. Its capacity will be increased and new machinery installed.

The Citizens' Light and Power Company, Sacramento, Cal., recently organized with a capital of $2,500,000, is planning to operate extensively in the light, power and gas business in this vicinity. G. W. Peltier, Sacramento, is head of this company.

The Fairview Pressed Brick Company, of Denver, Colo., has purchased the plant of the Golden Pressed Brick Company, at Golden, Colo., and intends to install new machinery to the amount of several thousand dollars for the manufacture of brick and all kinds of clay products.

CANADA

Clinton, Ont., will extend its waterworks pumping plant.

Revelstoke, B. C., will spend $50,000 on a new power plant.

Tofield, Alberta, will install a new waterworks pumping plant.

The Medicine Hat Glass Works will equip a $100,000 plant there.

Revelstoke, B. C., will buy a quantity of road-making machinery.

Toronto, Ont., will buy large quantities of road-making machinery.

The Canadian Paint Company is building a new factory at Montreal.

The Canada Cement Company will locate a large, new plant at Winnipeg.

Alex Cross & Sons will equip a $100,000 fertilizer plant at Sydney, N. S.

Thessalon, Ont., will install a new electric-lighting plant and power house.

North Bay, Ont., is in the market for new waterworks pumping machinery.

The Otto Higel Piano Company is building a big addition to its Toronto factory.

The Crown Lumber Company, of Woodstock, Ont., is building a new factory.

The National Electric Heating Company will locate a big plant in Toronto.

Melville, Saskatchewan, will spend $60,000 for new waterworks machinery and equipment.

Camrose, Alberta, will spend $80,000 for new waterworks pumping machinery and equipment.

The big plant of the Canada Cement Company at Lakefield, Ont., will be doubled and the latest machinery installed.

Cotton Prints Company, Ltd., Montreal, Que., has land at St. Timothee, Que., and will erect a plant in the near future.

The Ritchie & Ramsay Company, New Toronto, Ont., manufacturing coated paper and cardboard, is erecting an addition.

Brandon, Man., will spend $300,000 installing a new electric railway and power house. W. Speakman, city engineer.

The Stadacona Hydraulic Company, of Quebec, Que., will locate a large power-developing plant near there. L. H. Gaudry in charge.

The Electric and Gas Lighting Company, of Moncton, N. B., will make important extensions to its plant. O. P. Boggs, manager.

The Canadian Automatic Heating and Refrigerating Company will equip a plant at Windsor, Ont. F. Kerby, Windsor, in charge.

F. H. Keefer, K. C., of Port Arthur, Ont., is authority for the statement that a $7,500,000 packing plant will be established there.

Vancouver, B. C., will establish a municipal rock-crushing plant and will spend $1,000,000 for road-making machinery and improvements.

Regina, Saskatcheawn, is calling for tenders for sewage pumps, motor switchboard and complete equipment for sewage disposal works.

The Galt and Elmira branches of the Grand Trunk will probably be electrified very shortly and much new equipment will be needed.

The plant of the Kensington Furniture Company, of Goderich, Ont., completely destroyed by fire, will be rebuilt at once. Loss, $100,000.

The immense shingle mills of the Pitt River Lumber Company, destroyed by fire, will be completely reëquipped at once. Loss, $150,000.

Hon. Adam Beck, of London, Ont., is in charge of a hydro-electric line to be built from St. Thomas, Ont., to Windsor, costing $2,000,000.

The North Weyburn Telephone Company, of Weyburn, Saskatchewan, is in the market for full equipment for a new line extending over 30 miles.

Fifteen thousand dollars' worth of machinery destroyed by fire in the planing mill of George McAllister at Guelph will be replaced immediately.

G. R. Geary, chairman of the board of control of Toronto, is calling for tenders for a large quantity of transformers for the hydro-electric stations of the city.

The British Columbia Telephone Company, of Victoria, B. C., will make big extensions to its system and will require large quantities of electrical equipment.

Fifty thousand dollars worth of machinery, destroyed by fire in the sash and door factory of Louis Beaudry, at Point aux Trembles, Que., will be replaced at once.

Hon. P. McSweeney, of Moncton, N. B., is interested in a company which will build a railway and develop the Albert mines and will need much machinery and equipment.

Ten thousand dollars' worth of machinery destroyed in the planing mill of the James Smart Manufacturing Company, of Brockville, by fire, will be replaced immediately.

Souris, Man., is calling for tenders for two gasolene or oil engines, duplex, triplex or turbine pumps, two compression tanks and an air compressor and all necessary shafting and belting.

R. M. Simpson, of Winnipeg, is interested in the new Hudson Bay, Peace River & Pacific Railway, which will build a line from Winnipeg to Hudson bay, and will need large quantities of machinery and equipment.

MINING

The Champion mine, Prescott district, Ariz., will build a 50-ton cyanide plant.

The Gold Queen mine, Courtland district, Cochise county, Ariz., is planning to install a 20-ton cyanide mill.

The Twin Buttes Mining Company, operating near Tucson, Ariz., is planning to build a 350-ton smelting plant.

The Atlas Mining Company, operating the Jack Pot mine, near Wonder, Nev., is contemplating the erection of a mill.

The Garfield Mining Company, operating the Bell mine, near Mina, Nev., is planning to install a 100-ton mill in the near future.

The Harris Copper Company, operating in Black cañon, near Phoenix, Ariz., is contemplating the erection of a concentrating plant.

The C. O. D. Consolidataed Mining Company, operating the Gold Bar mine, near Goldfield, Nev., will build a 50-ton reduction plant.

The Murdock mine, Nigger Flat, near Placerville, Cal., is contemplating the installation of a new stamp mill in the near future.

The Beatson Copper Company, Latouche Island, near aVldez, Alaska, is planning to install a reduction plant during the coming summer.

The New York-Searchlight mine, Searchlight, Nev., is planning to install an 80-ton reduction plant. W. W. Hurt is the head of this company.

J. B. Washburn and S. F. Ortega, Wagon Mound, N. M., are at the head of an enterprise for extensive coal-mining work in this section, due to recent discoveries. As this is new property, considerable machinery for operation will be required.

BUSINESS ITEMS

The New York store of the Cole Hardware Company has been moved to 176 Centre street.

William Gardam & Son, Inc., have moved their New York office and shop to 80-86 Park place.

The Boston office of the Triumph Electric Company has been removed from 101 High street to 92 Pearl street, C. A. Cotton district office manager.

The Standard Gauge Steel Company, Beaver Falls, Penn., has established an office in the Old Colony building, Chicago, Ill., to be in charge of John Gillen.

The main office, steel department, wholesale and retail supply departments of Peter A. Frasse & Co., have been moved to 417-421 Canal street, New York city.

The Sullivan Machinery Company, Chicago, Ill., announces the establishment of an office at Salisbury House, London, E. C., England, which will have general charge of its business in England and on the continent. Howard T. Walsh is to be in charge of the new office.

TRADE CATALOGS

The Rowbottom Machine Company, Waterville, Conn. Circular. Ball-bearing disk grinder. Illustrated.

Triumph Electric Company, Cincinnati, O. Bulletin No. 461. Direct-current generators, engine type. Illustrated, 12 pages, 6½x9½ inches.

Sprague Electric Company, 527-531 West Thirty-fourth street, New York. Catalog No. 323. Electric fans. Illustrated, 36 pages, 8x10½ inches.

General Electric Company, Schenectady, N. Y. Bulletin No. 4806. Electric fans and small power motors. Illustrated, 42 pages, 8x10½ inches. Bulletin 4709. Waterwheel-driven alternators. Illustrated, 12 pages, 8x10½ inches. Bulletin No. 4820. Curve drawing ammeters and voltmeters. Illustrated, 6 pages, 8x10½ inches.

FORTHCOMING MEETINGS

National Association of Manufacturers, annual convention, May 15, 16, 17, Waldorf-Astoria hotel, New York city. Geo. S. Boudinot, secretary, 30 Church street, New York city.

National Machine Tool Builders' Association, spring meeting, May 18-19, 1911, Hotel Marlborough-Blenheim, Atlantic City. Chas. E. Hildreth, secretary, Worcester, Mass.

International Master Boiler Makers' Association, Omaha, Neb., May 23, 24, 25, 26, 1911.

American Foundrymen's Association, annual convention, Pittsburg, Penn., May 23 to 26, 1911. Richard Moldenke, secretary, Watchung, N. J.

American Society of Mechanical Engineers, spring meeting, Pittsburg, Penn., May 30 to June 2, 1911. Secretary, C. W. Rice, 29 West 39th St., New York City.

Society of Automobile Engineers, midsummer meeting, Dayton, Ohio, June 15, 16 and 17, 1911. C. F. Clarkson, secretary, 1451 Broadway, New York city.

The Institute of Operating Engineers. Regular meeting second Thursday of each month, Engineering Societies building, New York City. M. W. Rice, secretary, 29 West Thirty-ninth street, New York City.

American Society of Mechanical Engineers; monthly meeting second Tuesday. Calvin W. Rice, secretary, 29 West Thirty-ninth street, New York City.

Boston Branch National Metal Trades Association. Monthly meeting on first Wednesday of each month, Young's hotel. D. F. S. Clark, secretary, 141 Milk street, Boston, Mass.

Providence Association of Mechanical Engineers. Monthly meeting fourth Tuesday each month. E. C. Bliss, president, 91 Sabine street, Providence, R. I.

New England Foundrymen's Association; regular meeting second Wednesday of each month, Exchange Club, Boston, Mass. Fred F. Stockwell, 205 Broadway, Cambridgeport, Mass.

Engineers' Society of Western Pennsylvania; monthly meeting third Tuesday. Elmer K. Hiles, secretary, Fulton building, Pittsburg, Penn.

Superintendents' and Foremen's Club of Cleveland; monthly meeting third Saturday. Philip Frankel, secretary, 310 New England building, Cleveland, O.

Western Society of Engineers, Chicago, Ill. Regular meeting first Wednesday evening of each month, excepting July and August. Secretary, J. H. Warder, 1735 Monadnock block, Chicago, Ill.

Philadelphia Foundrymen's Association; meetings first Wednesday of each month, Manufacturers Club, Philadelphia, Penn. Howard Evans, secretary, Pier 45 North, Philadelphia, Penn.

WANTS

Rate 25 cents per line for each insertion. About six words make a line. No advertisements abbreviated. Copy should be sent to reach us not later than Friday noon for ensuing week's issue. Answers addressed to our care, 505 Pearl Street, New York, will be forwarded. Applicants may specify names to which their replies are not to be forwarded, but replies will not be returned. If not forwarded, they will be destroyed without notice. No information given by us regarding any advertiser using box number. Original letters of recommendations or other papers of value should not be inclosed to unknown correspondents. Only bona-fide advertisements inserted under this heading. No advertising accepted from any agency, association or individual charging a fee for "registration," or a commission on wages of successful applicants for situations.

MISCELLANEOUS WANTS

Caliper catalog free. E.G.Smith, Columbia, Pa.

Tools, dies, jigs, etc., built to order. W. C. Munz, Erie, Penn.

Special machinery developed and manufactured. Tompkins Bros. Co., Troy, N. Y.

Telescopic oil-stone holder, 25c. F. J. Badge, 286 Tnaffe Place, Brooklyn, N. Y.

Wanted—To buy a small machine shop in New England. Box 778, AMER. MACHINIST.

We buy or pay royalty for good patented machine or tool. Box 282, AMER. MACHINIST.

"Engineering Data." For shop, drafting room and office. Box 788, AMER. MACHINIST.

Wanted—Work for screw machines and gear cutter. Box 775, AMERICAN MACHINIST.

Light, fine machinery to order; models and electrical work specialty. E. O. Chase, Newark, N. J.

Light and medium weight machinery and duplicate parts built to order; tools, jigs, etc. MacCordy Mfg. Co., Amsterdam, N. Y.

Able mechanical engineer (Danish), going abroad this summer, wishes to represent American firm while there. Box 785, AM. M.

Commercial engineer seeks British agency for really good American specialties; please write fully. AJJ, 59 Aldermanbury, London.

Punches and dies, jigs and fixtures, light and medium weight machinery, etc., built to order. Taylor-Shantz Co., Rochester, N. Y.

Wanted—Machine and press work; tools, dies, jigs and machines built to order. The G. M. Diehl Machine Works, Wabash, Ind.

Patents. C. L. Parker, Patent Attorney, ex-examiner Patent Office, 990 G St., Washington, D. C. Write for Inventor's Handbook.

Wanted—Work for gear cutters, hand turrets, milling machines, etc.; fine work in quantities. The Seneca Falls Mfg. Co., Seneca Falls, N. Y.

Gear cutting, spur, bevel spiral wanted; parts machinery and complete machines built. The T. C. M. Manufacturing Co., 46 Lawrence St., Newark, N. J.

Light and medium weight machinery and small parts in quantities; also screw machine and punch press work, tools, jigs, dies and high grade machinery. The Elgin Tool Works, Elgin, Ill.

$2.00 will buy castings and all material for neatly designed automatic steam engine of 1/16 horsepower; engine has rotary valve with adjustment for wear; blueprints and instruction sheets 25 cents. Elgin Wheel & Engine Co., Dept. B, Elgin, Ill.

We can save you time and money, designing your machinery, tools, jigs and fixtures; let us develop your ideas and make your patent office drawings. Toledo Engineering Co., 544 Oakwood Ave., Toledo, Ohio.

Wanted—We are in the market to have a number of machines built about medium weight; only house with first class tools and in the vicinity of New York need answer this ad. Box 773, AMERICAN MACHINIST.

Large English firm of machine tool importers having showrooms and offices in Great Britain, France, Germany, Italy, India and Japan is wanting good agencies for machine tools of all kinds. Box 189, AMER. MACH.

Manufacturer, with capital, wanted to assist introducing small patented metal article for which great demand can be proven; is simple, practical, and has been described in reading columns of AMERICAN MACHINIST. "Reasonable," Box 767, AMER. MACHINIST.

Welding by oxy-acetylene process; special attention given to repairs of machinery and castings of all kinds; large experience in difficult experimental work; structural shapes welded together; write for particulars. Krajewski-Pesant Co., 54 Beard St., Brooklyn, N. Y.

Manufacturer of telegraph machines, adding machines, taxameters, accurate interchangeable parts, dies and special tools, invites orders for similar special manufacturing. The Universal Telegraphic Company, Successors to the Rowland Telegraphic Company, Baltimore, Md.

Proposals for ordnance supplies. Watervliet Arsenal, Watervliet, N. Y., April 15, 1911. Sealed proposals, in triplicate, will be received until 1 p.m., May 15, 1911, for furnishing steel, hardware, forage, fuel, oils, etc., during year ending June 30, 1912; information furnished on application. Lieut-Col. W. W. Gibson, Commanding.

Wanted—Machine work; a thoroughly well equipped machine tool shop, having accumulated considerable of its own product, and desiring to employ its full organization, is open for work of good class, and solicits contracts from $500 to $50,000; location, Central West. Box 765, AMERICAN MACHINIST.

An inventor of several compressed air and steam specialties for which there is a growing demand with no competition, would like to arrange with reliable concern to manufacture same on royalty; this would mean a clean and profitable manufacturing business to parties who would do as they agree. Address "Steamair," AMERICAN MACHINIST.

Watervliet Arsenal, Watervliet, N. Y., April 1, 1911. Sealed proposals, in duplicate, subject to the conditions of the sale, will be received at this office until 10 o'clock a.m., May 1, 1911, for the purchase of condemned ordnance stores. Catalogs giving quantities, condition, etc., can be had on application to the Commanding Officer, Watervliet Arsenal, Watervliet, N. Y.

HELP WANTED

Classification indicates present address of advertiser, nothing else.

ILLINOIS

Foreman for forge department, steam hammers and bulldozers; must be capable and able to handle general line of forgings; state experience and wages expected. Box 782, AMERICAN MACHINIST.

MASSACHUSETTS

Wanted—Department foreman for 25 or 30 men; location, central Massachusetts. Box 734, AMERICAN MACHINIST.

Foreman wanted for forge and tool hardening department of a plant manufacturing small tools and special machinery; new equipment and increasing business should make this a desirable position for the right man. Box 740, AMERICAN MACHINIST.

Wanted—Designing draftsman with electrical experience, preferably with a technical education, for a permanent position with the General Electric Company, Lynn, Mass. Apply stating age, education, experience and salary expected by addressing Chief Draftsman, General Electric Co., Lynn, Mass.

MICHIGAN

Wanted—A factory superintendent for a steel stamping plant that is turning out a line of metal fixtures, novelties and hardware specialties; first class equipment for dies as well as production; growing business; splendid opportunity for a man who knows and can produce; attractive salary, and to the right man an interest if agreeable. Box 753, AMERICAN MACHINIST.

MISSISSIPPI

Wanted as foreman of shop experienced machinist; must be draftsman and familiar with manufacture and operation of generally used printing presses; give references, experience and salary expected. Panchrome Press Mfg. Co., Corinth, Miss.

NEW JERSEY

Wanted—Draftsmen, toolmakers and first class machinists. Address Saurer Motor Co., Plainfield, N. J.

Gear cutting foreman, with general experience; must know something about figures, and be familiar with spiral, worm and bevel gears; state age, experience and some idea of salary expected. Address "Gear Cutting," Box 690, AMERICAN MACHINIST.

Wanted—An experienced designer for light special machine tools and fixtures; thorough shop and drafting room experience necessary; some electrical training desirable; steady employment to competent man with an established record. Chief Engineer, Edison Laboratory, Orange, N. J.

NEW YORK

Wanted—Expert diemakers; steady work and good wages to first class men. Apply to Tool Foreman, 37 West 116th St., New York.

Wanted—A first class designer for special printing machinery; only those who can furnish the best of references need apply. Box 566, AMERICAN MACHINIST.

We want applications from men of the highest caliber, experienced in efficiency and industrial engineering; correspondence confidential. Box 784, AMERICAN MACHINIST.

Salesmen wanted in all manufacturing localities, to handle side line of machinery safety devices on commission; unlimited field; best references required. Box 769, AM. MA.

First class factory office man wanted who is also a draftsman and who has had sufficient training to enable him to write direct current wiring specifications. Address, stating age, nationality, experience in detail and salary expected. Box 763, AMER. MACH.

Wanted—Assistant tool room man; one who has had experience in tool room of shop under the Taylor system in tool making, grinding and checking; good opportunity for bright young man; state fully experience, references, age and salary expected. Box 752, AMERICAN MACHINIST.

Wanted—Superintendent with good executive ability and education; to have full charge of plant manufacturing high grade machine tools; must be competent to direct designing of new machine tools and special fixtures for accurately producing duplicate parts in quantities; state fully experience, education, age and salary. Box 781, AMERICAN MACHINIST.

Wanted—Time study man and speed boss experienced in shop under the Taylor system; must be thorough machinist, capable analyzing and standardizing operations and taking time studies, and able later to hold position as speed boss; state fully experience, references, age and salary expected to start; good future opportunity for right man. Box 751, AMERICAN MACHINIST.

Works Manager Wanted—An old established and well organized company, employing about one thousand men, and manufacturing a high class product, wishes to secure a capable works manager of large experience in the production of small and accurate mechanisms, such as adding machines, typewriters, firearms, etc.; man under 40 years of age preferred; applicants are requested to give their experience in full, state age, positions occupied and furnish list of references; to the right man a permanent position is assured, at liberal salary. Box 772, AMER. MACH.

OHIO

Wanted—Draftsman with experience on electric traveling cranes; steady employment and good wages to competent man. Address Toledo Bridge & Crane Co., Toledo, O.

Wanted in northern Ohio, man to take charge of power punch presses, making metal stampings; state experience, where formerly employed and salary expected. Box 768, AMERICAN MACHINIST.

Wanted—First class machinists, toolmakers, die sinkers, lathe, planer, drill press, screw machine, boring and milling machine operators, wood and metal patternmakers, brass polishers, buffers, finishers, millwrights, hammermen and blacksmiths, who wish to increase their opportunities, to register with the free Employment Department of the National Metal Trades Association, New England Building, Cleveland, Ohio.

PENNSYLVANIA

Designer and draftsman for general machinery; location within 100 miles of New York City. Box 693, AMERICAN MACHINIST.

First class man to take charge of the operation of bevel gear planers and spur gear cutters; to a man who can produce good results, an excellent position is offered. Box 780, AMERICAN MACHINIST.

Wanted—One foreman mechanic at $1500 per annum; a competitive examination will be held May 12, 1911, for the purpose of filling the above position. For further information address "Governor," U. S. Naval Home, Philadelphia, Penn.

The Monotype School is maintained to train young men to meet the constant demand for operators of our type casting and composing machine; these operators do so well that we receive more applications for places than can be filled; these qualifications carry most weight: Common sense, automatic machinery experience, printing office experience, type foundry experience. Full particulars will be furnished to inquirers who furnish the same information about themselves, and mention this paper. Lanston Monotype Machine Co., Philadelphia.

RHODE ISLAND

Wanted—Fifty tool designers; experienced competent men in the design of jigs, fixtures, punches and dies and other special tools used in the manufacture of high grade machine parts on an interchangeable basis; apply by letter stating age, experience and salary required, as well as the date when you would be able to start if application was accepted. The Taft-Peirce Manufacturing Company, Woonsocket, R. I.

WISCONSIN

Wanted—By a firm manufacturing saw mill machinery, an experienced toolmaker with common sense ideas and good habits; married man about 35 years of age preferred. Box 783, AMERICAN MACHINIST.

Wanted at Once—Expert tool designer and machine shop foreman; thorough mechanic having experience with good machine shop practice and production; state actual experience, age, references and salary expected. Box 764, AMERICAN MACHINIST.

SITUATIONS WANTED

Classification indicates present address of advertiser, nothing else.

CONNECTICUT

A-1 tool designer and mechanical draftsman; seven years' varied experience; practical man; New England States preferred. Box 771, AMERICAN MACHINIST.

KANSAS

Machinist and engineer with technical education and wide experience on general repair work and millwrighting, wants position as master mechanic or equivalent. Box 762, AMERICAN MACHINIST.

MASSACHUSETTS

Mechanical inspector, holding responsible position with large concern, wishes to change location. Box 777, AMERICAN MACHINIST.

Machine designer, five years' shop and 10 years' drafting experience on automatic, special and shoe machinery. F. W. Meyer, Gen. Del'y, Northampton, Mass.

MICHIGAN

Mechanical engineer, experienced on gas engines, gas producers and other machines, is open for engagement; competent to organize engineering department; thorough, accurate, reliable. Address "Engineer," AM. MA.

Position in executive or engineering force; five years with present concern, in various capacities, from draftsman to assistant superintendent; wide experience in vacuum pans and salt making equipment; age 27; references. Box 779, AMER. MACHINIST.

NEW JERSEY

Am wanting to be placed with responsibility in the valve and fittings line; have qualified in the various departments between foundry and shipping room, particularly the tool, and can produce the papers to show for it. Box 776, AMERICAN MACHINIST.

NEW YORK

Superintendent of high inventive ability and expert mechanic, desires to change. Box 787, AMERICAN MACHINIST.

Patternmaker foreman; age 43; experienced in electrical, engine, pump and shipyard work. Box 774, AMER. MACHINIST.

Correspondence student, age 22, desires position in drafting room; five years' machinist experience. Box 775, AMERICAN MACHINIST.

Position as foreman or superintendent stamped metal goods, special machinery or drop forgings. "Foreman," 1625 41st St., Brooklyn, N. Y.

Manager or superintendent, capable of taking entire charge of a manufacturing plant, desires to make a change; experience with and references from three of the largest, best known plants in America. Box 754, AMERICAN MACHINIST.

Premium Work—Man for several years in charge of the premium work in large shop would change; competent to install system thoroughly and take charge of all work in connection with it; successful rate setter. Answer "Premium," AMERICAN MACHINIST.

Graduate mechanical engineer, nine years' general experience, five years with air compressor builders, design, testing, development of electric driven units, special problems in air and natural gas compression, sales engineering and publicity work, wants responsible position with compressor builders; at present employed. Box 770, AMER. MACH.

OHIO

Technical graduate, eight years' shop, engineering and executive experience. Box 786, AMERICAN MACHINIST.

FOR SALE

Sturtevant blower, special make Douglas pump and swaging machine, for sale cheap. Address Stern Bros. & Co., 33 Gold St.

Old established plant manufacturing high grade line of equipment, for sale; in operation thirty-seven years; now running; price right. Wm. H. H., 1818 Holland St., Erie, Penn.

For Sale—One story and basement brick machine shop, forty by one hundred feet, fully equipped for light work, now running, located in growing town within fifty miles of Philadelphia, on two trunk lines; or will combine with party having good light mechanical line; references exchanged; no agents or triflers. Box 747, AMERICAN MACHINIST.

For Sale—One second-hand 8½x16" Potter & Johnston automatic chucking and turning machine, in use for just four years, and having had the best care is in very good condition; has standard 3 9/16" spindle, triple geared automatic change speed head, heavy cross slide, oil pump and oil pan base; the machine is fitted with a special drawback bar and hand lever for operating expanding collet arbors through the spindle, somewhat similar to the backfacing attachment; the backfacing attachment sometimes supplied with these machines, could quite easily be fitted to it; weight, 8000 pounds. Box 766, AM. MA.

Talks With Our Readers

By The Sales Manager

Some time ago the Federation of Trade Press Associations and the American Trade Press Association held a joint banquet in New York.

The members of these associations are publishers of trade and technical papers.

Let us say right here that there is a general misunderstanding of the meaning of "trade" and "technical" as applied to papers. The word "trade" is a general term wrongly used to cover every kind of a periodical outside of general and religious magazines. As a matter of fact a trade paper is one which appeals to dealers in different industries who buy goods to sell at retail. The technical paper—of which the AMERICAN MACHINIST is an example in the engineering class—appeals directly to users and buyers of goods.

At this banquet one of the interesting and instructive speeches was delivered by Wm. H. Ingersoll, advertising manager of R. H. Ingersoll & Bro., makers of the famous Ingersoll watch.

Probably every man in the country has heard of Ingersoll watches and millions carry them. Fourteen thousand are made and sold every day.

"The world lives on two things," said Mr. Ingersoll, "the production of goods and the distribution of them."

Distribution of goods means the selling of them. Mr. Ingersoll pointed out very clearly that any method of distributing goods costs real money, and that the most economical method was advertising. Hence, advertising, instead of adding to the cost of goods, actually reduced the cost by using the most economical method of selling that is known.

When a concern succeeds, as Mr. Ingersoll's concern has succeeded, in making and marketing an accurate timekeeper at $1.00 retail, it proves the point.

At a general meeting of salesmen of the Ingersoll Company, it was shown that every time a seven-jewel, or better grade of watch is sold, a workman is given and paid for a day's work. These are watches retailing for more than $1.00. And these salesmen went out with that thought in their minds; the advertising is being done with that thought behind it, with the result that both salesmen and advertising are booming the business.

Advertising is the greatest factor in distribution and upon distribution depend the salaries of all of the AMERICAN MACHINIST'S readers, and our own modest stipend. Why, then, should not the subject of advertising be of interest to every man old enough to know what it means?

Advertising can be a tremendous power for good or evil, depending wholly upon how it is conducted.

This power touches intimately the life of every man and woman.

Civilization comes about through the distribution of commodities, and the latter comes about through the transportation facilities of the country and the information of how, where and when to get what we want or what will be good for us—in other words, plain advertising.

If it were not for this distribution, you know as well as we that each community would be a world unto itself, and each would be living in a sort of "darkest Africa" condition.

Now, if this is true, and if advertising in some of its multiple forms is playing its big part in the good work, isn't it worth while to tell all we can about it to those of our readers who, now or some time, must buy things for use in their work?

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Only reliable products can be continuously advertised.